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Forest
Service

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Environmental Assessment

Tennessee Creek Project

**Leadville Ranger District, San Isabel National Forest
Lake County, Colorado**

**Eagle - Holy Cross Ranger District, White River National Forest
Eagle County, Colorado**



Mt. Zion looking towards Turquoise Lake. Photo by J. Windorski

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CHAPTER 1 – INTRODUCTION

Document Structure

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

Chapter 1 – Introduction: This section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need.

Chapter 2 – Comparison of Alternatives, including the Proposed Action: This section provides a more detailed description of the agency's proposed action as well as an alternative method for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies.

Chapter 3 – Environmental Consequences: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment/existing condition is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

Chapter 4 – Agencies and Persons Consulted: This section provides a list of preparers and agencies consulted during the development of the environmental assessment.

Appendices: The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Leadville Ranger District Office in Leadville, Colorado.

Introduction

The Forest Service is proposing to complete vegetation management (both mechanical and prescribed fire treatments), wildlife habitat improvement, and watershed improvement projects on 16,450 acres. The majority of the project area is within the Leadville Ranger District of the San Isabel National Forest in Colorado. A minor part of the project area is located at the Ski Cooper Ski Area (Ski Cooper) within the Eagle-Holy Cross Ranger District of the White River National Forest in Colorado. This action is needed to create forest conditions that are more resilient to outbreaks of insect, disease and wildfire; to improve habitat for threatened, endangered and sensitive species and other important wildlife species; and to provide for sustainable watershed conditions.

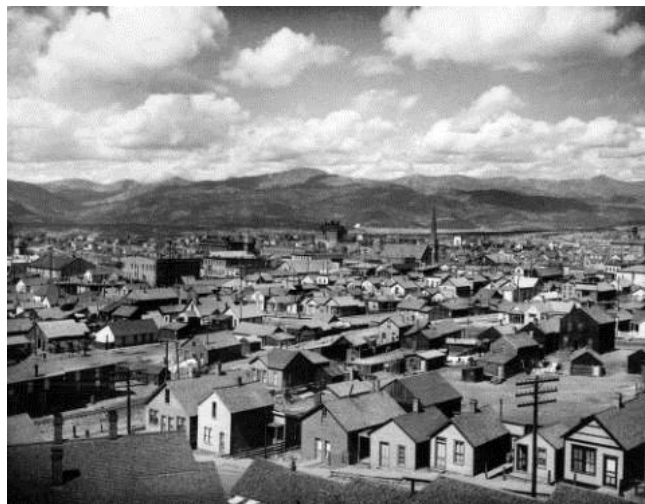
The proposed action would create short term impacts that would provide long term benefits for the project area. Short term impacts would include modifications to the visual scenery, smoke from prescribed fire, and temporary shifts of visitors and wildlife from project implementation.

Background

During the late 19th and early 20th centuries in Lake County the forests were being extensively logged to provide charcoal for kilns, ties for railroads in the area, mine props, and the general needs for sawn lumber for the area (Mehls 2006; Mulholland 2013). The extensive logging, followed by wildfires, resulted in a large regeneration event for lodgepole pine (*Pinus contorta*) resulting in the relatively even-aged lodgepole pine landscape we find throughout much of the project area today. Lodgepole pine is the dominant vegetation type in the project area with most forest stands between 110 to 130 years old.



Carbonate Hill 1890 – 1900 © Denver Public Library.



Leadville 1890 – 1900 © Denver Public Library.

In the late 1990s, the first signs of a mountain pine beetle (*Dendroctonus ponderosae*) epidemic were seen in the Rocky Mountain Region (USDA Forest Service 2012, pp. 2). The epidemic escalated and heavily impacted forest stands on the Arapaho-Roosevelt, Medicine Bow-Routt, and White River National Forests. Mountain pine beetle infestations also occurred on the Pike and San Isabel National Forests, but not to the extent as the northern forests.

A large portion of the water for the urban corridor along the Front Range of Colorado either originates in, or is conveyed through the headwaters of the Arkansas River Basin. Turquoise Lake, as well as Twin Lakes further south, is the storage area for many municipalities including Colorado Springs Utilities, Pueblo Water Works, and Aurora Water.



Beetle-killed stands on the White River National Forest.

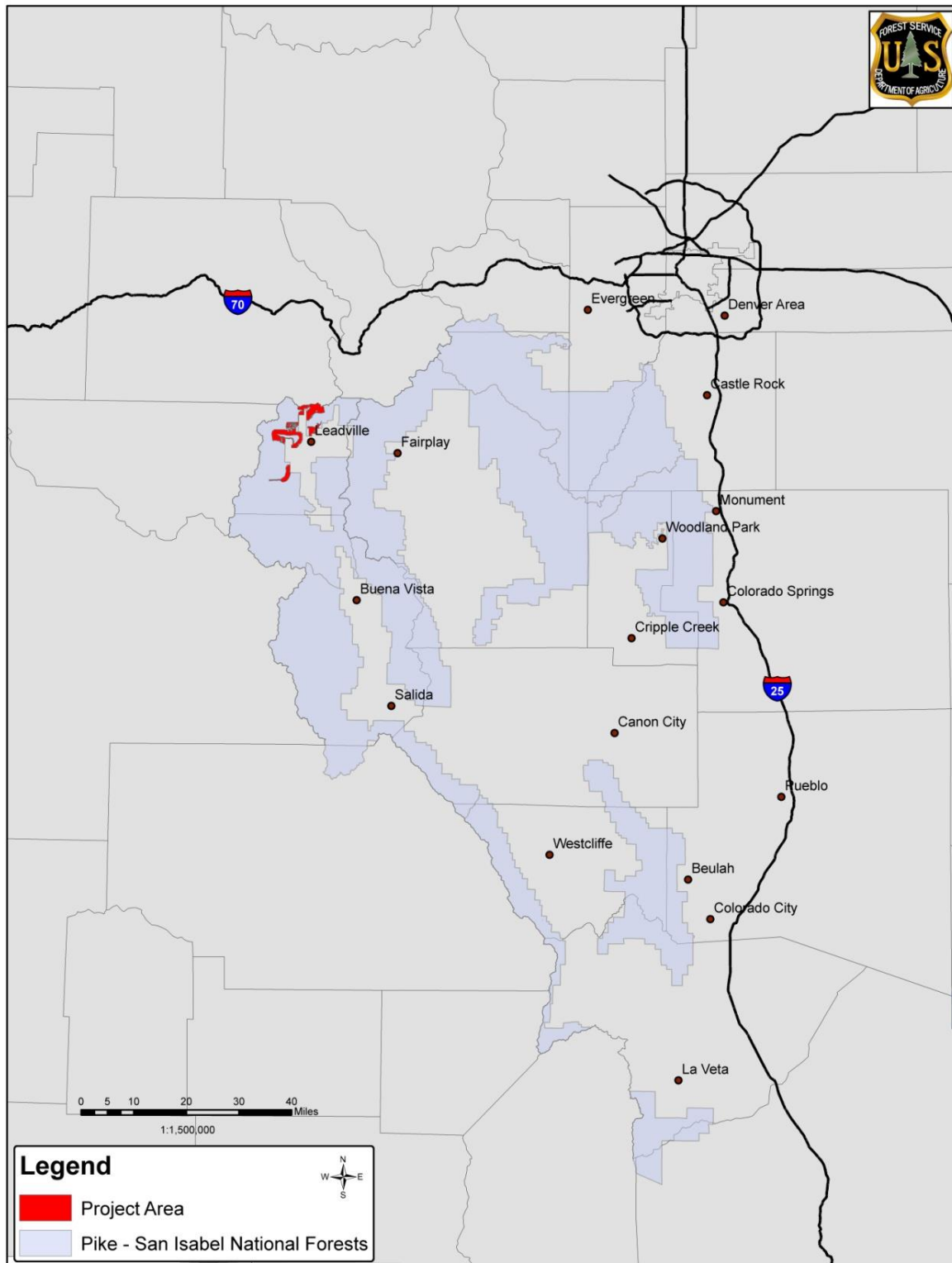
As a result of the beetle epidemic, citizen groups, water groups, as well as Forest Service specialists began discussing ideas to improve the overall health and resiliency of the forest.

Location and Setting

The proposed Tennessee Creek Project is located north, northeast, northwest, and west of the town of Leadville, Colorado. The project area is located from Halfmoon Creek, north to Tennessee Pass, and east/southeast to Mt. Zion. The majority of the project area is within the Leadville Ranger District of the San Isabel National Forest in Colorado. A minor part of the project area is located within the Eagle-Holy Cross Ranger District of the White River National Forest in Colorado (Ski Cooper).

The project area covers approximately 16,450 acres. The legal description of this project area includes all or parts of T8S, R80W, Sections 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 31, 32, 34, 35, and 36; T8S, R81W, Section 36; T9S, R80W, Sections 1, 2, 3, 6, 7, 8, 10, 11, 16, 17, 18, 19, and 20; T9S, R81W, Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, and 26; and T10S, R81W, Sections 12, 13, 24, 25, 26, 27, and 28, Sixth Principal Meridian.

Figure 1.1 Tennessee Creek Project Vicinity Map



Lodgepole pine is the dominant vegetation type within the Tennessee Creek project area, but other minor vegetation types are also evident including: spruce-fir, aspen, sagebrush, and meadows. The project area is heavily used for both summer and winter recreation. Multiple campgrounds are located at both Turquoise Lake and Halfmoon Creek. Ski Cooper Ski Area, as well as the Tennessee Pass Nordic Center, are located within the project area at Tennessee Pass. Outfitter and guide permittees and special use events utilize the entire project area. Multiple big game species, such as: elk, deer, big horn sheep, and moose are found throughout the project area. The project area also encompasses habitat for Canada Lynx (*Lynx Canadensis*) and its prey species as well as habitats for other Forest Service sensitive species.

Management Direction

The portion of this project located on the San Isabel National Forest is tiered to the Final Environmental Impact Statement for the Land and Resource Management Plan for the Pike and San Isabel National Forests, Comanche and Cimarron National Grasslands (PSICC; USDA Forest Service 1984) as amended; hereafter known as the Forest Plan. The proposed treatments located on the San Isabel National Forest respond to the goals and objectives outlined in Chapter III of the Forest Plan and help move the project area towards desired conditions in that Plan. Within the Forest Plan, lands are delineated and managed for a particular emphasis or theme known as a Management Area Prescription. The Forest Plan divides the Tennessee Creek project area between the following Management Area Prescriptions (Figure 1.2 and Table 1.1):

- Prescription 1B-1 emphasizes providing for downhill skiing on existing downhill ski sites.
- Prescription 2A emphasizes semi-primitive, motorized recreation opportunities such as snowmobiling, four-wheel driving, and motorcycling.
- Prescription 2B emphasizes rural and roaded-natural opportunities.
- Prescription 4B emphasizes the habitat needs of one or more management indicator species.
- Prescription 4D emphasizes maintaining and improving aspen sites.
- Prescription 5B emphasizes forage and cover on winter range.
- Prescription 7D emphasizes production and utilization of small roundwood.
- Prescription 9A emphasizes riparian area management.

The portion of the project located on White River National Forest (Ski Cooper) is tiered to the Final Environmental Impact Statement for the White River National Forest Land and Resource Management Plan (LRMP) 2002 Revision (USDA Forest Service 2002). The LRMP Management area for the Tennessee Creek project area is:

- Management Area 8.25 – Ski Areas –Existing and Potential
Ski areas are developed and operated by the private sector to provide opportunities for intensively managed outdoor recreation activities during all seasons of the year.

This proposal moves the project area toward the desired conditions described in the goals and objectives outlined in the LRMP. The LRMP goals, objectives, and strategies applicable to this analysis include the following:

Goal 1: Promote ecosystem health and conservation using a collaborative approach to sustain the nation's forests, grasslands, and watersheds.

Objective 1d: Increase the amount of forest and rangelands restored to or maintained in a healthy condition with reduced risk and damage from fires, insects, disease, and invasive species.

Strategy 1d.7: Implement management practices, including prescribed fire, which will move landscapes towards desired vegetation composition and structure as described in the management area description and the Historic Range of Variability.

Strategy 1d.9: Over the life of the plan, management practices that mimic ecological processes (such as fire, insect and disease, and other disturbances) on forest and grassland landscapes in a manner consistent with desired conditions and management area direction.

Goal 2: Provide a variety of uses, products, and services for present and future generations by managing within the capability of sustainable ecosystems.

Objective 2c: Improve the capability of national forests and rangelands to sustain desired uses, values, products, and services.

Strategy 2c.1: By the end of the plan period, offer for sale the allowable sale quantity.

Goal 5: Engage the American public, interested organizations, private landowners, state and local governments, federal agencies, and others in the stewardship of NFS lands.

Objective 5a: Work cooperatively with individuals and organizations, and local, state, tribal, and federal governments to promote ecological, economic, and social health and sustainability across landscapes.

Strategy 5a.1: Provide opportunities for local governmental jurisdictions and other interested parties to participate in planning and management of National Forest System lands, especially where local governmental jurisdictions or other landowners are contiguous to these lands or may be affected by the management of them.

Strategy 5a.2: Cooperatively work with local governments to address issues of common concern and to the extent possible, maintain consistency with locally adopted master plans.

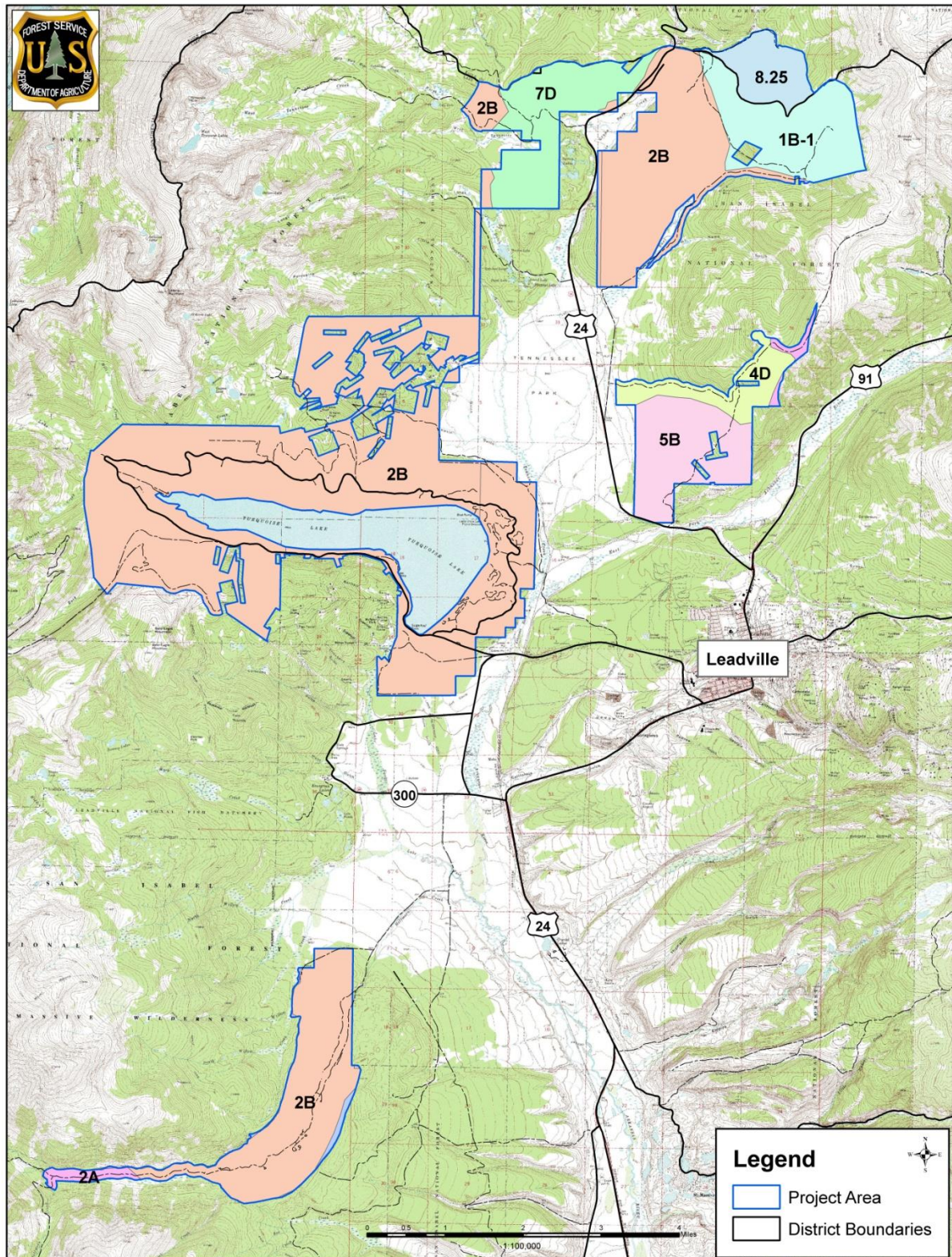
Strategy 5a.3: Involve local governmental representatives and other landowners adjacent to or affected by the management of National Forest System lands in the monitoring and evaluation of implemented forest plans.

Table 1.1 Project Acres by Management Area

Forest	Management Area **	Project Acres
Pike – San Isabel NF	Prescription 1B – 1	1,180
	Prescription 2A	195
	Prescription 2B	11,730
	Prescription 4B	45
	Prescription 4D	530
	Prescription 5B	1,085
	Prescription 7D	1,165
White River NF	8.25 – Ski Areas – Existing and Potential	520
Total project acres		16,450

** The project area includes approximately 1,220 acres of riparian corridors (9A) within these management areas.

Figure 1.2 Management Areas within the Project Area



Purpose and Need for Action

The purpose and need of the Tennessee Creek Project are: to create forest conditions that are more resilient to insects, diseases, and fire; to improve or maintain habitat for threatened, endangered and sensitive species and other important wildlife species; and to provide for sustainable watershed conditions. The objectives of this project are:

- Create conditions in treated forest stands that are less favorable for mountain pine beetle infestation for the next 20 – 30 years.
- Reduce the risk of high intensity wildfire through the reduction in hazardous fuels.
- Reduce the negative impacts that wildfire could have on watersheds, including the municipal watershed reserves and water system infrastructure for the cities of Aurora, Pueblo, Colorado Springs, and other local municipalities.
- Promote tree species and age class diversity.
- In the event of tree mortality from bark beetles, salvage beetle-killed lodgepole pine and spruce before it loses its marketable value.
- Maintain and enhance threatened, endangered and sensitive species habitats, and other important fish and wildlife habitats over the next 20 – 30 years.
- Produce additional Canada lynx winter foraging and denning habitats and maintain connectivity across the landscape over the next 20 – 30 years.
- Improve water quality, enhance aquatic and riparian habitat, and improve aquatic organism passage in the project watersheds.
- At Ski Cooper, use silvicultural methods to promote a healthy, diverse forest structure that minimizes mortality from insects and disease and provides a visual experience for visitors that is free of widespread tree mortality in the forested areas. Provide for protection of ski area employees, guests and infrastructure by minimizing the impact from potential insect and disease outbreaks resulting in high mortality to the forested area of the ski resort.

Proposed Action

The proposed action is a balance between improving forest health conditions and wildlife habitat while maintaining the overall recreation experience. The Tennessee Creek project area is approximately 16,450 acres. Of the total project area, approximately 13,580 acres have been proposed for treatment. It is anticipated that the proposed action would be implemented over the next 10 – 15 years.

Below is a summary of the actions proposed by the Forest Service to meet the purpose and need of the Tennessee Creek Project. A full description of the proposed action is located in Chapter 2.

- Regenerate lodgepole pine through prescribed fire and/or mechanical means.
- Thin mature lodgepole pine stands. Pre-commercial thin advanced regeneration of lodgepole pine.
- Improve the health of aspen stands through prescribed fire and/or mechanical means.

- Remove encroaching conifers in meadows and sagebrush and use prescribed fire treatments in meadows throughout the project area.
- Create small openings in spruce-fir and mixed conifer stands by harvesting lodgepole pine to promote regeneration.
- Remove spruce infested with or killed by insects.
- Maintain vegetation cover and increase age class and structure diversity over the long-term within the Ski Cooper Ski Area permit boundary utilizing mechanical and prescribed fire treatments in lodgepole and spruce-fir.
- Improve aquatic organism passage through the removal or replacement of non-functioning culverts on National Forest System roads.
- Improve wildlife habitat through vegetation management, closing non-system routes, creating snags, and constructing nesting platforms.
- Improve erosion and compaction issues in developed sites (campgrounds and picnic areas).
- Improve aquatic habitat, reconstruct channel geometry, reduce erosion, and normalize sediment transport in Halfmoon Creek.
- Improve and maintain National Forest System roads including widening a portion of Forest System Road (FSR) 109.
- Create approximately 20 miles of temporary roads and open approximately 1.5 miles of closed roads over the life of the project; roads would be closed and rehabilitated after treatments are complete.

Decision Framework ---

Given the purpose and need, the deciding official will review the proposed action and the other alternatives. The District Ranger is the Responsible Official who will make the following decisions:

- Whether or not or to what degree to conduct vegetation management and improve wildlife habitat and watersheds within the Tennessee Creek project area.
- Based on the analysis, select the proposed action, or other action alternative that has been considered in detail, or modify an action alternative. Identify the design criteria and any mitigation measures to be applied during project implementation.
- Whether to not approve the proposal and require the effects of the proposed action to be analyzed through an Environmental Impact Statement (EIS).

Public Involvement and Tribal Consultation ---

The proposal was originally listed in the Schedule of Proposed Actions (SOPA) in October 2009 and updated quarterly during the analysis. As part of the public involvement process, the agency sent out informational letters regarding the project in June 2012, held a public field trip in July 2012, and throughout the winter of 2012/2013 conducted multiple presentations to community groups regarding the project.

The proposal was provided to the public and other agencies for comment during scoping that began on November 8, 2012. There were 17 responses received. In addition, an Open House was held on January 15, 2013. A flyer was distributed in Leadville and was published in the Leadville *Herald Democrat*, as well as at LeadvilleToday.com.

Both the public interest letter and the scoping letter were sent to representatives of the Ute Mountain Ute Tribe, the Southern Ute Indian Tribe, the Jicarilla Apache Nation, and the Ute Indian Tribe (Uintah and Ouray Reservation). No responses were received from the tribes that were contacted.

Using the comments from the public and other agencies, the interdisciplinary team developed a list of issues to address.

Issues

Issues are points of concern about environmental effects that may occur as a result of implementing the proposed action. Some are generated by the public and are in response to the proposed action.

Issues identified during scoping can either be addressed by developing alternatives to the proposed action or by adjusting the proposed action to resolve conflicts [36 CFR 220.7(b)(2)(i)]. Many issues and concerns were already addressed as part of the project design, were outside the scope of the project or already decided by law or regulation. Documentation of all comments received during scoping is located in the project file.

ISSUES IDENTIFIED FOR THIS ANALYSIS

Impacts on Forest Health

The majority of the lodgepole pine stands throughout the project area are even-aged mature stands with little species or age class diversity. Aspen stands are becoming decadent and losing vigor. These conditions create stands that are more susceptible to insect, disease, and wildfire.

There are concerns that some forest stand treatments would increase wind throw and increase conditions that are more susceptible to wildfire because of added surface fuel loading from slash created and blow down.

Impacts on Wildlife

Some forest treatments that are proposed would change wildlife habitat conditions. There are concerns that these changes could potentially adversely impact wildlife populations, including big game species and Canada lynx. There are additional concerns that the treatments would occur during sensitive times for wildlife, reduce habitat, and increase hunting pressure.

Impacts on Recreation

Some forest treatments that are proposed would occur within and adjacent to popular recreation sites including campgrounds, trailheads, and trails including the Continental Divide National Scenic Trail (CDNST). The project area is heavily used by recreationists, as well as outfitters and guides.

There are concerns that the project would adversely impact recreational opportunities and visitor perception of the natural setting, as well as create conflicts with visitors.

Impacts from Roads

As part of the forest treatments, opening of decommissioned roads and construction of new temporary roads are proposed. There are concerns that the public use of these roads while treatments are underway may cause user conflict or safety hazards. In addition, the Forest Service needs to ensure the proper closure and hydrologic stability of these roads at project completion.

ISSUES CONSIDERED BUT NOT ANALYZED IN DETAIL

- Conducting work on private, county or state lands. Forest Service does not have the authority to conduct treatments on private, county or state lands. As part of the Tennessee Creek Project, the Forest Service would work with Colorado State Forest Service to complete projects that occur on adjacent private lands.
- Outdated Forest Plan. The Land and Resource Management Plan for the Pike and San Isabel National Forests is from 1984. Updating the Forest Plan is outside the scope of this project. This project is consistent with the 1984 Forest Plan standards and guides. The Forest Service does use the best available science in its planning process.
- The use of temporary roads for recreation. Under the Tennessee Creek Project, temporary roads would not be open to the general public. Only administrative and permitted traffic would be allowed. Temporary roads would be rehabilitated after their use for this project.
- Dispersed recreation and its impacts in Halfmoon Creek. Addressing dispersed recreation and travel management issues is outside the scope of this project. Work to limit resource damage in the Halfmoon Creek drainage will continue based on guidance found in the Forest Plan and direction associated with Motor Vehicle Use Map (MVUM).

CHAPTER 2 – ALTERNATIVES

Chapter 2 describes and compares the alternatives considered for the Tennessee Creek Project. This section also presents the alternatives in a comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Alternatives were developed from resource concerns identified by the Interdisciplinary Team and comments received from the public.

Alternatives

The project area was divided into two subunits, the Massive and Tennessee Pass subunits. These subunits correlate to the Lynx Analysis Units. The total acres for each subunit are listed below.

Table 2.1 Acres by Subunit

Project Area* (acres)	Massive Subunit (acres)	Tennessee Pass Subunit (acres)
16,450	7,960	8,480

* Difference in acres from project total is an ArcGIS error when cutting polygons. Project boundary total is the official acreage.

NO ACTION ALTERNATIVE

Under the No Action Alternative, current management plans would continue to guide management of the project area.

Listed below is a representation of the current management taking place in the Tennessee Creek project area; it is not intended to be all inclusive of current management activities.

- Vegetation management (thinning, group selection, patch cuts, chipping of slash, and fuelwood) within the campgrounds and developed sites at Halfmoon Creek and Turquoise Lake would continue. A vegetation management plan is in place for the developed sites. Annual treatments average 7 – 10 acres per year (approximately 180 acres total for the project).
- Hazard tree removal at developed sites, Ski Cooper, and along National Forest System trails and roads would continue as needed.
- Northwest Leadville Hazardous Fuels Project would continue. Treatments would include pre-commercial thinning, thinning of mature stands, pile burning, and broadcast burning. Annual treatments average 10 – 20 acres per year (approximately 470 acres total for the project).
- Using Forest Plan Direction, continue improvement and rehabilitation of the area adjacent to Halfmoon Creek (within 100 feet of the creek). Treatments include using boulders and buck and rail fence to restrict access and seeding to re-vegetate areas.
- Rehabilitate non-system and user-created routes. Treatments include using boulders and buck and rail fence to restrict access and seeding to re-vegetate areas.

- Noxious weed monitoring and treatments.
- Regular or routine maintenance of National Forest Service system trails and roads.
- Recreation activities would continue as authorized including: snowmobiling, Nordic and alpine skiing, off-highway vehicle (OHV) use, biking, and hiking.
- Outfitter and guide activities and other special events would continue as permitted.

ALTERNATIVE 1 – PROPOSED ACTION

SUMMARY

- Regenerate lodgepole pine through mechanical means on 2,370 acres.
- Thin 6,765 acres of mature lodgepole pine stands. Pre-commercial thin 345 acres of advanced regeneration of lodgepole pine (7,110 acres total would be thinned).
- Improve the health of aspen stands through prescribed fire and/or mechanical means on 115 acres.
- Mechanical treatments (thinning / clearcuts) would average 300 – 500 acres per year.
- Utilize prescribed fire on 6,040 acres with an average of 150 – 300 acres of treatment per year.

TREATMENTS BY VEGETATION TYPE

Lodgepole Pine – Clearcuts / Openings

Treatments that result in openings would not exceed 25 percent of the lodgepole pine stands (Table 2.2). The treatments would provide species and age class diversity in lodgepole pine, reduce dwarf mistletoe, and improve big game (e.g., elk, deer, and bighorn sheep) foraging habitat. In addition, the treatments would potentially reduce the possibility of and negative effects from large scale insect and disease outbreaks and wildfires using the following guidance and constraints:

1. Openings would be created through prescribed fire or mechanical means. For openings created mechanically (clear cuts), the openings would be limited to 40 acres or less in size and where practical, would have irregular shapes and variable retention clumps of trees .
2. Prescribed burn treatment units may exceed 40 acres and may include mechanically-treated and untreated areas.
3. Slash left on-site would be lopped and scattered, piled and burned, broadcast burned, crushed with yarding and harvesting equipment, or utilized for biomass.
4. Reserve areas would be left on the landscape as refuge for wildlife species. Reserve areas would be located throughout the project area and would consist of steep areas (greater than 35 percent), inaccessible areas, and wet areas. In mapped lynx habitat, stands with greater than 35 percent dense horizontal cover would also be retained. In addition to this, approximately 10 percent of the areas identified for thinning would be left as reserve areas. There would be at least 200 feet distance between adjacent clearcuts to provide secure travel corridors for wildlife. Thinning and prescribed fire treatments may occur within some

of the corridors, while others would remain untreated. Old growth, areas with closed canopy or with substantial quantities of coarse woody debris would be targeted and incorporated into reserve areas between treatments and areas containing important wildlife habitat features such as squirrel middens.

Table 2.2 Alternative 1: Treatable Acres in Lodgepole Pine

Subunit	Current acres of lodgepole pine	Creation of openings (lodgepole pine only)	Thinning acres (lodgepole pine only)
Massive	5,080	1,270	3,810
Tennessee Pass	4,400	1,100	3,300
Total	9,480	2,370	7,110

*Acres calculated using treatable acres only. Acres do not include “no treatment” areas.

Lodgepole Pine - Thinning

The following guidance and constraints would be used in thinning lodgepole pine on all remaining acres outside of the openings:

1. In lodgepole pine stands only, reduce basal area (BA) to an average of 80 – 120 square feet per acre. Overall, basal area may differ substantially from one point to another. Basal area reduction goals may not be met in some stands due to high initial basal area and to concerns about creating conditions susceptible to blow down. Additional future treatments would be needed to achieve basal area reduction goals.
2. Preference would be given to retaining other species (e.g., spruce, fir, and aspen) over lodgepole pine. The spacing would be variable as described in #3 below.
3. Trees would be thinned in a manner to create clumps or cohorts of trees intermingled with small, irregular openings or areas of lower tree density. Pockets of dwarf mistletoe-infected trees and lodgepole interspersed with aspen would be targeted for removal to create openings and provide for species diversity.
4. Slash left on-site would be lopped and scattered, piled and burned, or utilized for biomass. Broadcast burning may take place in 25 – 50 percent of thinned areas.
5. Public fuelwood opportunities would be provided.
6. Pre-commercial thinning of young lodgepole pine stands may take place on approximately 345 acres of lodgepole pine.

Table 2.3 Alternative 1: Acres of Pre-commercial Thinning

Subunit	Total acres of pre-commercial thinning
Massive	305
Tennessee Pass	40
Total	345

Lodgepole Pine – Prescribed Fire

Prescribed burn treatments would reduce litter and duff layers, slash produced by treatments, and surface fuels, as well as promote regeneration of lodgepole pine and aspen.

1. Before any prescribed burning would take place, appropriate burn plans and smoke management permits that address site-specific details would be completed and approved.

2. Prescribed fire could be used in most areas that have been treated mechanically or by hand, or it could be used as a treatment by itself. The exact burn treatment to be used and their locations would be determined after mechanical vegetation treatments are completed, and would depend on the level of natural and activity fuels, slope, soil type, and other related factors in each stand.

The objective of vegetation management in aspen would be to restore the health and vigor of the existing aspen stands and expand their current extent. Treatments would include the removal of competing conifer trees within all aspen stands and the cutting and/or burning of aspen to regenerate new growth within 25 percent of the aspen stands. By reducing competition and propagating younger trees, the health and vigor of the stands would be improved; the remaining and new aspen would have increased resistance to insect and disease and a freedom from encroachment and being over taken by conifers. In lodgepole pine stands, where there is an aspen component, clearcuts and patch cuts would be used to regenerate those areas to aspen, increasing the percentage of aspen within the project area.

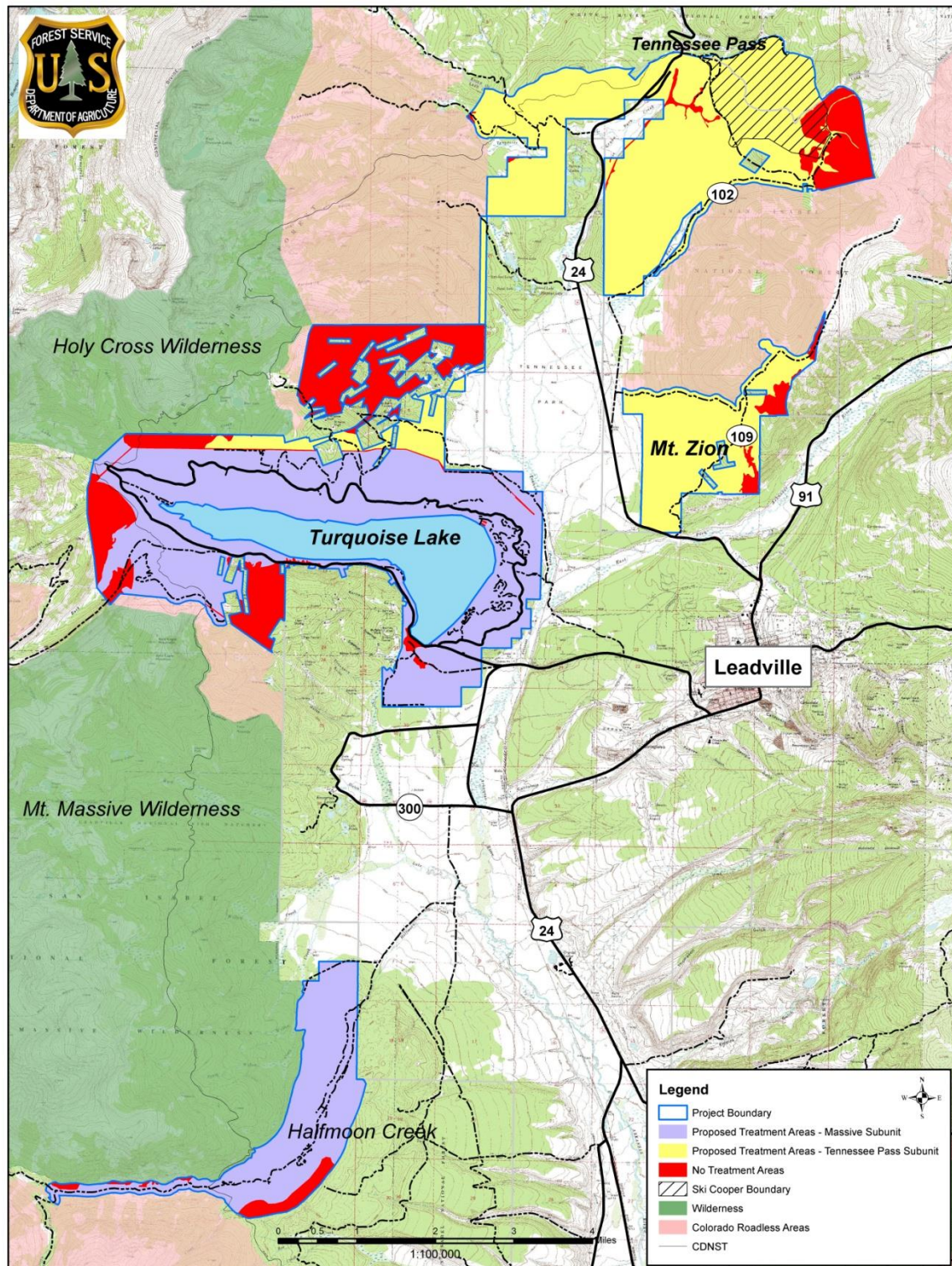
Prescribed burn treatments may also be used to stimulate propagation of new suckers. Prescribed fire may be used in areas that have been treated mechanically or it could be used as a treatment by itself. The same conditions listed for prescribed fire under lodgepole pine would apply.

Table 2.4 Alternative 1: Treatable Acres in Aspen

Subunit	Current acres of aspen	Creation of openings (aspen only)
Massive	225	57
Tennessee Pass	230	58
Total	455	115

*Acres calculated using treatable acres only. Acres do not include "no treatment" areas.

Figure 2.1 Map of Alternative 1 (Proposed Action)



ALTERNATIVE 2

SUMMARY

- Regenerate lodgepole pine through mechanical means on 3,790 acres.
- Thin 2,685 acres of mature lodgepole pine stands. Pre-commercial thin 345 acres of advanced regeneration of lodgepole pine (3,030 acres total would be thinned).
- Improve the health of aspen stands through prescribed fire and/or mechanical means on 180 acres.
- Mechanical treatments (thinning / clearcuts) would average 300 – 500 acres per year.
- Utilize prescribed fire on 5,485 acres with an average of 150 – 300 acres of treatment per year.

TREATMENTS BY VEGETATION TYPE

Lodgepole Pine – Clearcuts / Openings

Treatments that result in openings would not exceed 40 percent of the lodgepole pine stands (Table 2.5). The treatments would provide species and age class diversity in lodgepole pine, reduce dwarf mistletoe, and improve big game (e.g., elk, deer, and bighorn sheep) foraging habitat. In addition, the treatments would potentially reduce the possibility of and negative effects from large scale insect and disease outbreaks and wildfires using the following guidance and constraints:

1. Openings would be created through prescribed fire or mechanical means. For openings created mechanically (clear cuts), the openings would be limited to 40 acres or less in size and where practical, would have irregular shapes and clumps of trees.
2. Prescribed burn treatment units may exceed 40 acres and may include mechanically-treated and untreated areas.
3. Slash left on-site would be lopped and scattered, piled and burned, broadcast burned, crushed with yarding and harvesting equipment, or utilized for biomass.
4. Reserve areas would be left on the landscape as refuge for wildlife species. Reserve areas would be located throughout the project area and would consist of steep areas (greater than 35 percent), inaccessible areas, and wet areas. In mapped lynx habitat, stands with greater than 35 percent dense horizontal cover would also be retained. In addition to this, approximately 10 percent of the areas identified for thinning would be left as reserve areas. There would be at least 200 feet distance between adjacent clearcuts to provide secure travel corridors for wildlife. Thinning and prescribed fire treatments may occur within some of the corridors, while others would remain untreated. Old growth, areas with closed canopy or with substantial quantities of coarse woody debris would be targeted and incorporated into reserve areas between treatments and areas containing important wildlife habitat features such as squirrel middens.

Table 2.5 Alternative 2: Treatable Acres in Lodgepole Pine

Subunit	Current acres of lodgepole pine	Creation of openings (lodgepole pine only)	Thinning acres (lodgepole pine only)
Massive	5,080	2,030	2,250
Tennessee Pass	4,400	1,760	780
Total	9,480	3,790	3,030

*Acres calculated using treatable acres only. Acres do not include “no treatment” areas.

Lodgepole Pine – Thinning

The following guidance and constraints would be used in treating lodgepole pine outside of the clearcuts adjacent to Turquoise Lake, ditches associated with water rights, and areas within the wildland urban interface only (Figure 2.2). Approximately 5,050 acres are located in the identified thinning areas. Of the identified acres, approximately 3,030 of those acres would be available for thinning.

1. In lodgepole pine stands only, reduce basal area to an average of 80 – 120 square feet per acre. Overall, basal area may differ substantially from one point to another. Basal area reduction goals may not be met in some stands due to high initial basal area and to concerns about creating conditions susceptible to blow down. Additional future treatments would be needed to achieve basal area reduction goals.
2. Preference would be given to retaining other species (e.g., spruce, fir, and aspen) over lodgepole pine. The spacing would be variable as in Alternative 1.
3. Trees would be thinned in a manner to create clumps or cohorts of trees intermingled with small, irregular openings or areas of lower tree density. Pockets of dwarf mistletoe-infected trees and lodgepole interspersed with aspen would be targeted for removal to create openings and provide for species diversity.
4. Slash left on-site would be lopped and scattered, piled and burned, or utilized for biomass. Broadcast burning may take place in 25 – 50 percent of thinned areas.
5. Public fuelwood opportunities would be provided.
6. Pre-commercial thinning of young lodgepole pine stands may take place on approximately 345 acres of lodgepole pine.

Table 2.6 Alternative 2: Acres of pre-commercial thinning

Subunit	Total acres of pre-commercial thinning
Massive	305
Tennessee Pass	40
Total	345

Lodgepole Pine – Prescribed Fire

Prescribed burn treatments would reduce litter and duff layers, slash produced by treatments, and surface fuels, as well as promote regeneration of lodgepole pine and aspen.

1. Before any prescribed burning would take place, appropriate burn plans and smoke management permits that address site-specific details would be completed and approved.

2. Prescribed fire could be used in most areas that have been treated mechanically or by hand, or it could be used as a treatment by itself. The exact burn treatment to be used and their locations would be determined after mechanical vegetation treatments are completed, and would depend on the level of natural and activity fuels, slope, soil type, and other related factors in each stand.

Aspen

The objective of vegetation management in aspen would be to restore the health and vigor of the existing aspen stands and expand their current extent. Treatments would include the removal of competing conifer trees within all aspen stands and the cutting and/or burning of aspen to regenerate new growth within 40 percent of the aspen stands. By reducing competition and propagating younger trees, the health and vigor of the stands would be improved; the remaining and new aspen would have increased resistance to insect and disease and a freedom from encroachment and being overtaken by conifers. In lodgepole pine stands, where there is an aspen component, clearcuts and patch cuts would be used to regenerate those areas to aspen, increasing the percentage of aspen within the project area.

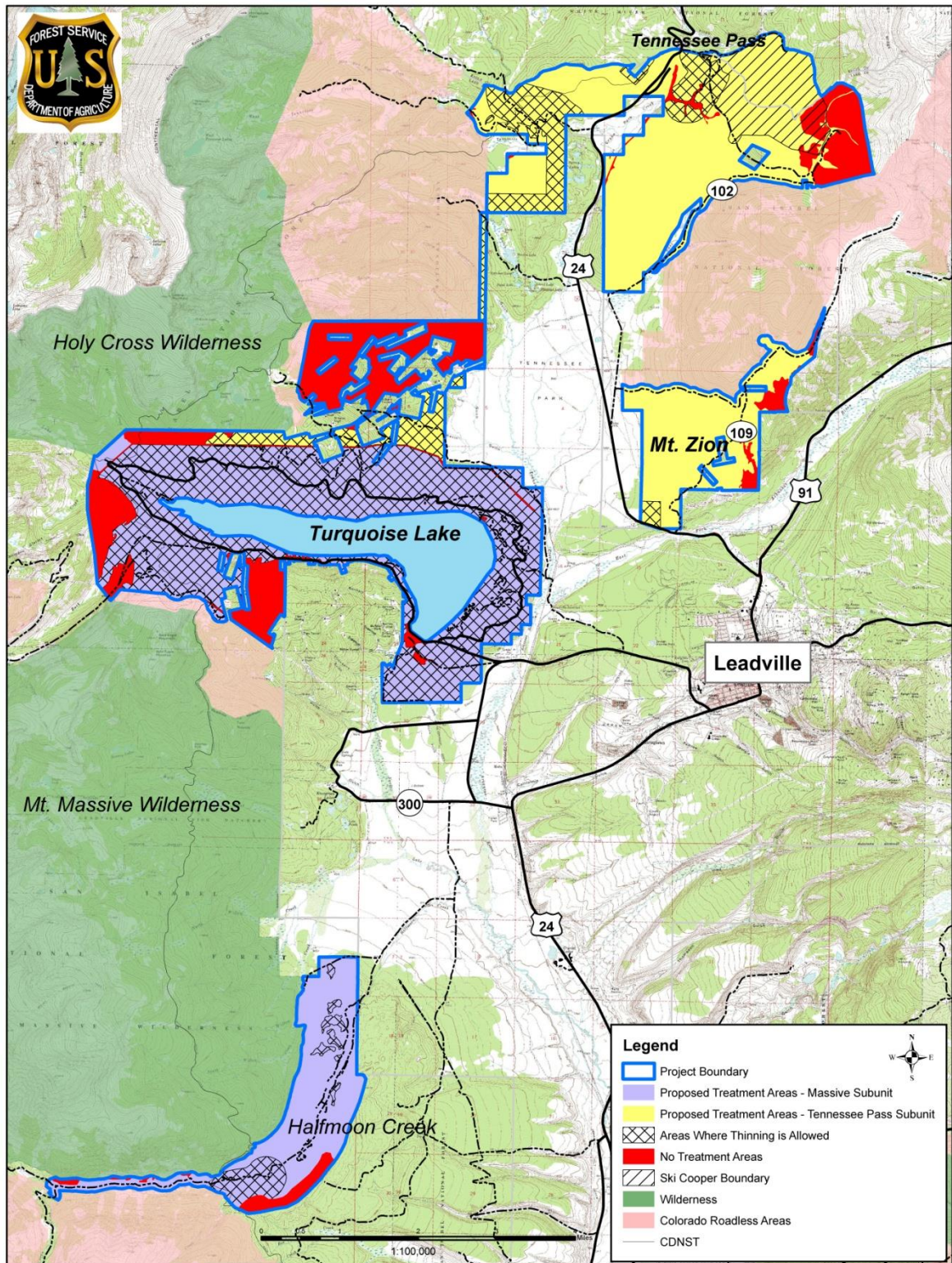
Prescribed burn treatments may also be used to stimulate propagation of new aspen suckers. Prescribed fire may be used in areas that have been treated mechanically or it could be used as a treatment by itself. The same conditions listed for prescribed fire under lodgepole pine would apply.

Table 2.7 Alternative 2: Treatable Acres in Aspen

Subunit	Current acres of aspen	Creation of openings (aspen only)
Massive	225	90
Tennessee Pass	230	90
Total	455	180

*Acres calculated using treatable acres only. Acres do not include "no treatment" areas.

Figure 2.2 Map of Alternative 2



ACTIONS COMMON TO ALL ALTERNATIVES

The following actions are common to both action alternatives.

SUMMARY

- Remove encroaching conifers in meadows and sagebrush (1,345 acres) and use prescribed fire treatments in meadows throughout the project area (1,330 acres).
- Create small openings in the spruce-fir and mixed conifer stands by harvesting lodgepole pine to promote regeneration (375 acres).
- Remove spruce infested with or killed by insects (up to 1,395 acres).
- Maintain vegetation cover and increase age class and structure diversity over the long-term within the Ski Cooper Ski Area permit boundary (1,052 acres) utilizing mechanical and prescribed fire treatments in lodgepole and spruce-fir.
- Improve aquatic organism passage through the removal or replacement of 5 – 7 non-functioning culverts on National Forest System roads.
- Improve wildlife habitat through vegetation management, closing non-system routes, creating snags, and constructing nesting platforms.
- Improve erosion and compaction issues in four developed sites (campgrounds and picnic areas).
- Improve aquatic habitat, reconstruct channel geometry, reduce erosion, and normalize sediment transport in 2.3 miles of Halfmoon Creek.
- Improve and maintain National Forest System roads including widening a portion of Forest System Road 109.
- Create approximately 20 miles of temporary roads and open approximately 1.5 miles of closed roads over the life of the project; roads would be closed and rehabilitated after treatments are complete.

TREATMENTS BY VEGETATION TYPE

Meadows and Sagebrush

The objective of vegetation management in meadows and sagebrush would be to maintain the health and vigor of meadows and sagebrush fields and improve forage for wildlife on winter range. Treatments for both meadows and sagebrush would include the removal of encroaching conifer trees. Prescribed burn treatments would only be used in meadows.



Encroaching conifer in sagebrush. Photo by J. Windorski.

Spruce-Fir

General Treatment: In the transition area between lodgepole pine and spruce-fir (the mixed conifer) where the understory is underdeveloped, the objective of vegetation management would be to remove mature lodgepole pine to promote regeneration, thereby increasing foraging opportunities for snowshoe hare (the primary prey of Canada lynx). Individual treatment units would be between 0.1 and 5 acres. Areas that contain both substantial amounts of down, woody debris and high, horizontal cover (greater than 35 percent horizontal cover) would not be harvested. Spruce-fir would not be removed, except as stated below.

Spruce-fir with Insect and Disease Activity: As a pre-emptive treatment for spruce beetle or other insects and diseases that impact spruce forests, the following treatments would be allowed: salvage of dead trees, removal of trees infested with spruce beetles, and removal of green trees for skid trails, temporary roads, or where removal of salvaged trees would create conditions where remaining trees would blow over. Where appropriate, prescribed fire would be used to treat slash. The project area (including Ski Cooper) includes approximately 1,550 acres of spruce-fir stands. Up to 90 percent (1,395 acres) would be treated if necessary; 10 percent would be left for lynx denning habitat.

Vegetation Management at Ski Cooper Ski Area

Vegetation management on Ski Cooper would consist of a variety of treatments aimed at maintaining vegetation cover and increasing age class and structural diversity over the long-term. The exact treatment method would be determined based on stand conditions at the time of treatment.

Spruce-Fir: Treatments would consist of group and individual tree selection treatments and would be designed to develop multi-aged, multi-storied stands. In addition, where multiple species occur,

treatments would be designed that attempt to maintain or increase the number of species present within any particular stand.

In the event of increased spruce beetle populations at Ski Cooper, the trap tree methodology would be used to reduce spruce beetle populations in the localized area. The trap tree method involves felling groups or individual live standing trees, which attract beetles from a wide area. The trap trees are preferentially infested by these beetles and once infested, these trap trees are then hauled off site before the next generation of beetles can emerge (typically one year following their placement). Location of trap trees would be noted with GPS to facilitate later identification. This method would be used until Forest Service entomologists determine this method has either achieved success or (in the case of an intense beetle outbreak) is no longer effective in reducing spruce beetle populations.

Lodgepole Pine: Treatments would be developed to establish regeneration in the forest understory. Treatments would consist of removing enough overstory trees, generally less than 30 percent of the basal area, to provide suitable conditions for regeneration to become established. Patch clearcuts would be limited to less than 5 acres at Ski Cooper.

Planting tree islands within runs would be encouraged. Cones would be collected from local sources, germinated at a Forest Service nursery, and would be available for use in establishing young islands of trees within existing runs. Ski Cooper, in coordination with the Forest Service, could determine the best placement of these groups. However, it is suggested that they be placed below existing tree islands, where appropriate, to help provide seedlings with protection from skiers while they develop.

General Operations for Mechanically-Treated Units

Conventional ground-based logging systems would be used to remove logs from areas that are accessible using existing Forest System Roads, non-system routes, or constructed temporary roads. Vegetation management activities would occur throughout the year and may include winter logging operations.

ROADS

Forest System Roads

To improve access to the project area, substantial maintenance may occur on FSR 109 (Mt. Zion Road). Maintenance may include widening of the road and adding culverts where needed. Other roads within the project boundary may also require basic maintenance such as: culvert cleaning or replacement, water bar or rolling dip reshaping, or the addition of culverts, water bars, or rolling dips where needed.

Temporary Roads

The construction of temporary roads would follow approved Forest Service methodology. On constructed temporary roads and non-system routes, access would be restricted to authorized personnel only. Authorized personnel include Forest Service personnel, contractors and permittees (e.g., individuals who have a valid fuelwood permit). Access would be restricted through the use of

gates, barricades, or other means as appropriate. Temporary roads may not be gated while units are open for public fuelwood.

Approximately 20 miles of temporary road would be created and approximately 1.5 miles of closed roads would be open during the life of the project to access the project area, but mileage may vary during project implementation. A single length of temporary road typically would be less than 1 mile. Temporary roads and non-system routes would be rehabilitated after treatments are complete. This would include permanently closing the roads through techniques that include blocking the entrances, scattering limbs and brush on the roadbed, re-seeding, adding waterbars, removing fills and culverts, or reestablishing natural drainage patterns. No new Forest System Roads would be created with this project.

WILDLIFE HABITAT IMPROVEMENTS

Aquatic Organism Passage

To improve aquatic organism passage, culverts that prevent movement of aquatic organisms (e.g. fish) would be reinstalled, removed, or replaced with an appropriately sized and type of conveyance (e.g., standard culvert and bottomless arch culvert). Approximately 5 - 7 culverts may be removed or replaced as appropriate. Heavy equipment would be used and the appropriate permits would be obtained from the U.S. Army Corps of Engineers. Boulders, trees, and other native materials may also be used during installation or to rehabilitate the area.

Habitat Improvements

To protect and improve riparian ecosystems including boreal toad habitat, non-system routes and dispersed campsites that are near or go through riparian areas may be closed. Treatments include ripping, seeding, bouldering, fencing or other methods that would restrict access. Heavy equipment such as excavators may be used.

Snags would be created for cavity-dependent wildlife (e.g., birds and bats) in areas where minimum snag requirements are lacking (Forest Service 1984, pp. III – 12). Trees would be killed through girdling, prescribed fire, or other methods to create snags for cavity-dependent species.

Openings would be created through mechanical treatments in the transition area between lodgepole pine and spruce-fir to promote regeneration thereby increasing foraging opportunities for snowshoe hare, the primary prey of Canada lynx (see the Forest Treatments by Vegetation Type section for further details).

Openings would be created or augmented through mechanical treatments or prescribed fire to improve big game (elk, deer, and bighorn sheep) foraging opportunities and habitat where appropriate (see the Forest Treatments by Vegetation Type section for further details).

Encroaching conifers would be removed from sagebrush fields to improve sagebrush habitat for species such as the Brewer's sparrow (see the Forest Treatments by Vegetation Type – Meadows and Sagebrush section for further details).

Nesting platforms would be constructed and placed along the shoreline of Turquoise Lake to provide additional nesting opportunities for raptors (e.g., osprey and bald eagle). To create the nesting

platforms, trees may be topped or poles installed in specified locations. Heavy equipment would be used to create or place the platforms.



Nesting platform located at Twin Lakes. Photo by J. Windorski.

WATERSHED IMPROVEMENT PROJECTS

Soil Erosion at Developed Sites

Some developed sites (campgrounds and picnic areas) at Turquoise Lake have issues with soil erosion and compaction. To improve erosion and compaction issues, identified areas would be ripped (breaking up compaction), contoured, mulched, seeded, and/or have erosion control netting installed as needed. Both hand and mechanical treatments may be utilized and may include the use of heavy equipment (e.g., excavators). Approximately 25 acres of treatment would take place.

Developed sites that currently have soil compaction and erosion issues include: Molly Brown, Belle of Colorado, and Baby Doe Campgrounds, and Lady of the Lake Picnic area.



Soil erosion and compaction issues at Baby Doe Campground. Photo by L. Corbin.

Halfmoon Creek Watershed Restoration and Habitat Improvements

Natural river restoration techniques would be used to improve aquatic habitat, reconstruct channel geometry, reduce erosion, and normalize sediment transport from the confluence of Elbert Creek and Halfmoon Creek (Mt. Massive Trailhead) downstream to the U. S. Geological Service gaging station on Halfmoon Creek. Channel dimension, pattern, and profile would be restored based on the appropriate channel type(s) within this reach. Specific treatments would focus on creating additional pool and pocket water habitats, improving scour and residual pool depth in existing pools, reducing width/depth ratios, and stabilizing river banks. The restoration effort would utilize boulders, whole trees, and other native materials to mimic natural stream features, and would use a variety of structures and improvements (described below). Bank full riparian benching and stream bank toe slope stabilization would be accomplished utilizing toe wood, full length trees, transplanted willow, and sedges.

The objective would be to enhance aquatic habitat, improve hydraulic function, and reduce human impacts. Stream restoration activities were initiated in 1988 and continued into the early 1990's to address erosion, sedimentation, and poor fish habitat. Colorado Parks and Wildlife (CPW) has stocked brown trout into Halfmoon Creek in an attempt to provide a self-sustaining fishery, but this initiative has met with limited success. Past habitat improvement has been inadequate and prior habitat structures are in disrepair. The project would provide the habitat needed to sustain a viable recreational fishery by installing a variety of habitat improvement structures at designated locations within the 2.3 mile stream segment.

Improvements would be accomplished by walking heavy equipment (e.g. small track hoe) into Halfmoon Creek. Trees for log vanes and toe wood would be acquired from surrounding lodgepole pine in the Halfmoon drainage. These trees would be pushed over with the track hoe so that the root wads would remain intact. Rocks and boulders available on-site would be used for habitat enhancement, but additional rocks may be needed from off-site. Sod mats for riparian bench

creation would also be transplanted from vegetation available on-site and within reach of the track hoe arm. Four different reaches have been identified for improvements along the approximately 2.3 mile stretch of stream (Figure 2.3). Implementation would be done in phases for each reach. In Reach 1, approximately 23 structural improvements have been identified; in Reach 2, approximately 37 structural improvements have been identified; in Reach 3, approximately 33 have been identified; and in Reach 4, approximately 19 have been identified. Proposed activities and structures that would be utilized under this proposal are listed below. Re-vegetation of disturbed areas would occur as directed by the District Biologist.

Proposed Activities and Types of Structures include:

- Point bar development
 - Re-contour to narrow channel
 - Re-contour to widen channel
- Log vane
- Log cross vane
- Rock cross vane
- Wood toe (bank stabilization provided by using several trees with root balls attached, stacking them to lessen velocity and create fish habitat underneath the trees)
- Excavate ponds (whenever there are vanes created)
- Micro-vortex structure using rocks
- Macro-vortex structure using rocks
- Rock/boulder vane
- Riparian bank creation (using sod mats available on site)
- Cobble toe creation
- Boulder clusters to create small pools (rocks about 2 feet in diameter)
- Re-contouring or re-structuring of channel using variety of methods discussed in this document
- Rock groin
- Roughen riffle with rocks
- Create thalweg pool
- Install grade control structure
- Remove old man-made structure
- Create j-hook with log and rocks
- Create j-hook with rocks



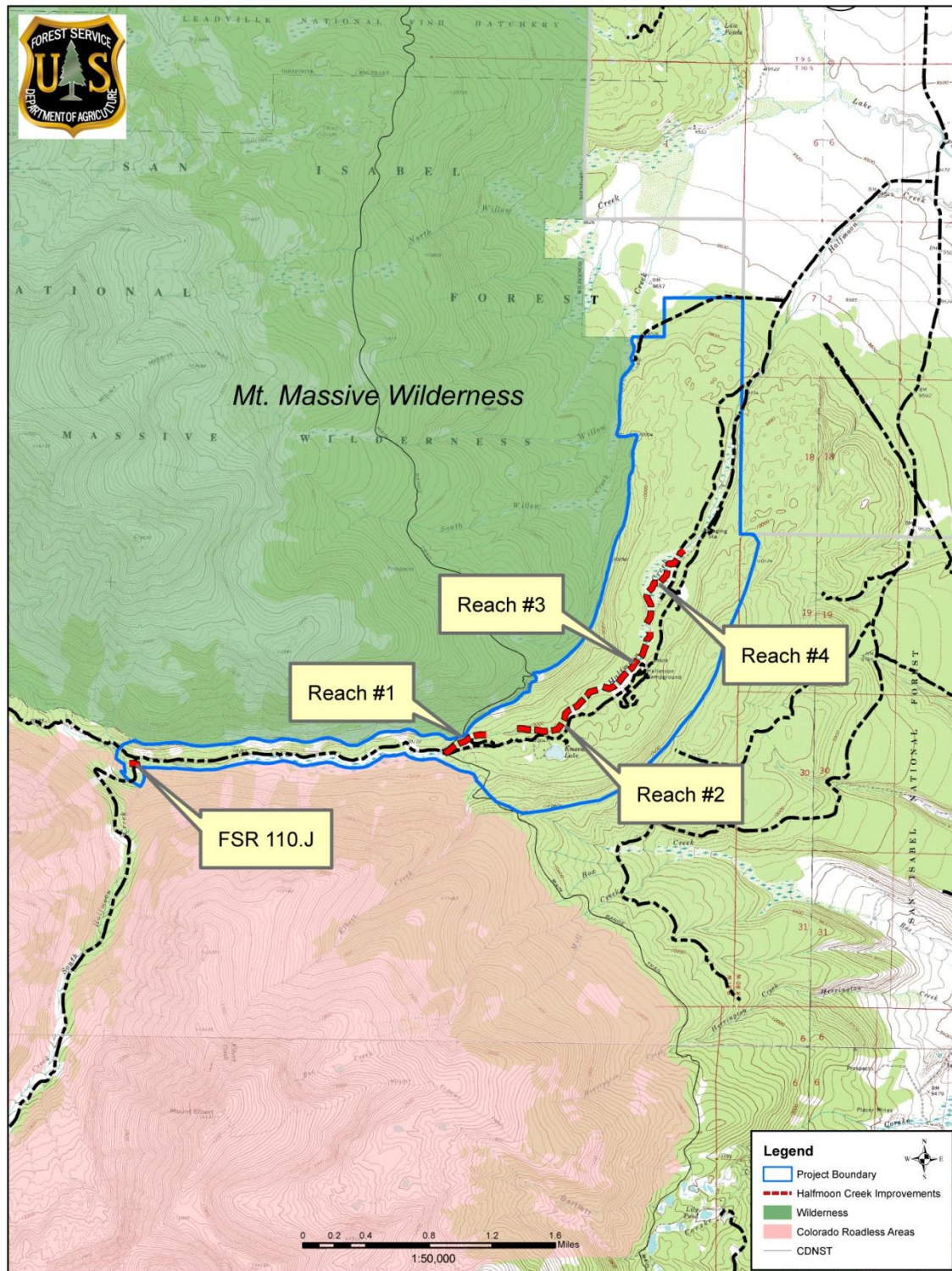
Example of a rock J-hook. Photo by G. Policky.



Example of log cross vane. Photo by G. Policky.

In addition to the reaches listed above, the project would also include stabilization of the road-water crossing located on FSR 110.J upstream of the confluence of South Halfmoon Creek and Halfmoon Creek (Figure 2.3). The crossing has widened over time and requires stabilization to reduce sedimentation input from the road and to improve aquatic organism passage through the crossing. The same types of treatments listed above would be utilized here.

Figure 2.3 Locations of Halfmoon Creek Watershed Restoration and Habitat Improvement Projects



DESIGN CRITERIA COMMON TO ALL ALTERNATIVES

Design criteria are an integral part of the action alternatives and serve to minimize the impacts of activities on natural resources. In addition to best management practices (BMPs) and legal requirements, these measures would be applied during implementation. The design criteria would apply to any of the action alternatives.

RECREATION

1. In order to facilitate coordination with permitted and approved activities such as outfitter and guides, recreation events, and mining operations, the Timber and Fire Management departments would notify the District Recreation Staff Officer in advance of treatment and hauling activities. This advance notification timeframe is typically April for the summer operating season and October for the winter operating season.
2. Where feasible, limit the multi-year duration of treatment activities within and immediately adjacent to developed sites of the Turquoise Lake Recreation Area (TLRA). These areas include west of Lake County Road 9 and 9C from the dam to Tabor Boat Ramp.
3. Treatment activities and hauling would be prohibited from noon Fridays through 6 a.m. Mondays and all Holidays from the Friday immediately preceding Memorial Day through Labor Day on the east side of TLRA and within ¼ mile of developed sites in the Halfmoon Creek drainage. Additional restrictions may be imposed for major recreation events such as the Leadville 100. Exceptions must be approved by the District Recreation Staff Officer.
4. Prohibit treatment activities and hauling within the Ski Cooper permitted boundary during their operating season (typical season is from December to April).
5. Prohibit hauling on FSR 101.C during Tennessee Pass Nordic Center's (TPNC) winter operating season (mid-November to mid-April) and from noon Fridays through 6 a.m. Mondays during the TPNC Cookhouse's summer operating season (end of June to the first of October). Exceptions must be approved by the District Recreation Staff Officer.
6. No treatments would occur in developed recreation sites while they are open to the public (typically Memorial Day to Labor Day). If closures are necessary, this would be coordinated with the District Recreation Staff Officer who will communicate with the concessionaire to reduce impacts.

GENERAL WILDLIFE

7. All new nesting and denning sites for threatened, endangered, or Forest Service sensitive species observed prior to or during implementation would be reported immediately to the District Wildlife Biologist and appropriate protection measures would be implemented.

SNAGS AND COARSE WOODY DEBRIS

San Isabel National Forest Snag and Coarse Woody Debris Design Criteria (#8 – 10)

Snags and recruitment snags are to provide for nesting, roosting, and foraging habitat for small mammals and birds (e.g., bats, woodpeckers, owls, and songbirds). These criteria do not apply to fuel breaks if they would compromise the integrity of the fuel break.

8. Maintain a **minimum** of 80 snags per 10 acre average of varying and large diameter size class. Guidelines for snags include:
 - a. Retain all soft snags (class 3, 4, and 5) except for safety hazards (USDA Forest Service 1984, pp. III – 12) to the greatest extent reasonable and practical.
 - b. Retain all hard snags (when they are present) in the largest size class available (pre-treatment) to meet the above targets.

If above existing snag levels are not available, provide for green recruitment snag trees sufficient to bring snag/recruitment snag levels up to the above mentioned target levels in a well distributed manner of both clumps and individual trees, of largest available trees. Trees with defects (e.g. “wolfy” appearance, dead tops, forked tops, cankers, heart rot, diseases, broken tops, and large limbs) would be selected when possible. Where practical, create new snags by girdling, burn plan design, or other means, as necessary to achieve target numbers of snags. Clumping (versus even spacing) of snags and recruitment trees is preferable if desired snag species and larger diameter snags are available for the snag retention clump. Locate snag patches adjacent to green trees to provide additional cover for wildlife species.

9. Assure that adequate coarse woody debris (CWD) is retained for wildlife use and nutrient recycling following mechanical and prescribed fire treatments by retaining an average of at least 200 linear feet of the largest diameter wood available per acre where feasible. In areas where the prescription includes pile burning, some piles would be left in each treatment area for wildlife habitat and to supplement a stand deficient in CWD.
10. The snag and CWD requirements should be retained through all treatment phases (e.g., commercial operations, fuelwood, and prescribed fire) with the realization that some existing snags may become CWD, retention trees may become snags, and CWD may be unintentionally consumed during implementation (e.g. due to wind throw and fire).

White River National Forest Snag and Coarse Woody Debris Design Criteria (#11 – 12)

11. Develop prescriptions during project planning to identify the amount, size(s), and distribution of downed logs and snags to be left onsite, as well as live, green replacement trees for future snags. On forested sites, retain snags and downed logs (where materials are available) in accordance with the average minimums specified in Table 2.8.

Table 2.8 Minimum requirements for snag, snag recruitment, and woody debris retention

Forest Type	Snags				Large Snags			Downed Logs	
	Minimum diameter at DBH (inches)	Retention density (number per acres)	Recruitment density (number per acre)	Minimum snag height (feet)	Minimum diameter at DBH (inches)	Retention density (number per five acres)	Minimum snag height (feet)	*Minimum diameter (inches)	Retention density (linear feet per acre)
Spruce-fir	10	3	3	25	20	1	50	10	150
Lodgepole	8	3	3	25	20	1	50	8	100
Aspen	8	3	3	25	20	1	50	8	50
Douglas-fir	10	3	3	25	20	1	50	10	100
Ponderosa	10	3	3	25	20	1	50	10	50

Note: These amounts are to be calculated as per-acre averages for each 1,000 acres over a Silviculture landscape assessment area (see Silviculture Guideline #1). The retention density of large snags is a portion of the retention density of all snags. *The minimum diameter of downed logs is measured at the larger end of the log.

12. If no snags meet the minimum diameter and height requirements, use the largest snags available.

Silviculture – Guideline #1: The landscape should be the primary unit of analysis for Silviculture. A landscape is defined here to mean a distinct landform, such as a mesa or an “Order IV” watershed. There is a great variety of landscape types within the Rocky Mountain Region. Some landscapes are “fine-grained” and are characterized by many small areas in various stages of plant succession. Other landscapes are “large-grained” – forested areas with large, unbroken expanses of trees with few openings. Some areas in the region have become a patchwork of forest and open places as a result of human use before national forest establishment, past Forest Service management practices, or natural disturbances (wind, fire, insect activity, and earth movement).

BIRDS

Unless consulted and agreed upon by the District Wildlife Biologist, the following criteria would be adhered to:

13. Because raptors nest in late winter and early spring and they can change nest locations annually, all proposed treatment areas would be surveyed for raptors and other nesting birds by a Wildlife Biologist to determine whether raptors (e.g. Northern goshawk, golden eagle, bald eagle) are present and actively nesting. If new nests are discovered, restrictions discussed below would be implemented.
14. An activity exclusion area consistent with the *Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors* around any active raptor nest (Colorado Division of Wildlife 2008) or threatened, endangered and sensitive bird species would be marked by the Wildlife Biologist and avoided (generally from March 1 to September 15). Buffer zone size and restriction dates would vary depending on species.
15. Active northern goshawk nests (any primary or alternate nest within a territory that has been utilized within the last 5 years) would be buffered by ½ mile radius for no disturbance from March 1 to September 15. A *minimum* 30 acre nest area would be delineated around the best habitat available, that includes each nest tree, and would be excluded from any harvesting activity.
16. To the extent practical and feasible, restrict prescribed burning from May 1 to August 15 in order to avoid disrupting migratory bird nesting and breeding.
17. Any trees that have evidence of being used as a nest tree (e.g., presence of constructed, natural or excavated nesting cavities, fecal whitewash, feathers, bolus pellets, skeletal bones, or fur of prey species present at or around the base of a tree) would not be cut.

BIG GAME

18. In forested areas, maintain a 200 foot deer and elk hiding cover buffer along 75 percent or more of each side of arterial and collector roads (USDA Forest Service 1984, pp. III – 153). Arterial and collector roads in the project area include FSR 100 Wurts Ditch Road, FSR 105 Hagerman Pass, and FSR 110 Halfmoon Road. Treatments would be allowed in the cover buffer as long as hiding cover is maintained.
19. To protect big game (mule deer, elk, bighorn sheep, and moose) critical winter range, winter range, and winter concentration areas seasonal restrictions for timber harvest and associated activities would be implemented on winter range within the project area from

December 1 to April 15. Prescribed burning activities may be acceptable during this time period and would be coordinated with the District Wildlife Biologist.

20. If conflicts with other species protection measures prohibit effectively operating during the summer months in an area (e.g., restrictions for raptor nest sites), timber harvest operations may take place on elk, deer, and moose (*not* bighorn sheep) winter range during the restriction period **IF both** of the following criteria are met:
- A locked gate would be placed at the entrance to temporary roads used to access a treatment area to prohibit all motor vehicle access (except for authorized administrative use including Forest Service personnel and timber contractors).
 - Only 20 percent of the mapped winter range would be operated on during the restriction dates to allow big game to utilize the other 80 percent during this time. This would allow up to 375 acres of treatment per year in elk and deer winter range and up to 180 acres of treatment per year in moose winter range during the restriction periods.
21. Avoid disturbing elk calving and mule deer fawning concentration areas from May 15 to June 30 (Colorado Parks and Wildlife 2013).

CULTURAL RESOURCES

22. Prior to any implementation activity, the District Heritage Resource staff would be contacted to ensure avoidance of all eligible or potentially eligible properties for the National Register of Historic Places (NRHP). All eligible or potentially eligible properties including a minimum 30 – 50 foot buffer (depending on slope and fuel loading) would be avoided and protected. Heritage Resource personnel would determine the buffer and mark the area prior to implementation of ground disturbing activities.
23. Hand Cutting (non-mechanized) fuels reduction within eligible site boundaries may be permitted with prior consultation with a member of the District Heritage Resource staff.
24. If artifacts, features, or other indications of previously unrecorded heritage resources are identified in the course of ground-disturbing activities, all work in the vicinity of those materials would cease and the District Heritage Resource staff would be notified immediately. Project activities may resume after proper notification, mitigations, and archeological clearances are obtained.
25. A member of the District Heritage Resource staff working closely with the Timber and Fire Management departments would provide avoidance area maps during pre-implementation meetings to ensure understanding of the heritage resources landscape. These maps would be for internal use only and may not define in detail the full extent of the site boundaries but would include a comprehensive listing of general site locations.

SOIL, WATER, RIPARIAN, AND AQUATIC RESOURCES

26. In general, no treatments would be allowed in the water influence zone (WIZ) and these riparian areas, including kettles holes, would be buffered up to 100 feet on each side of the WIZ. A site visit by the Hydrologist, Fisheries or Wildlife Biologist may allow flexibility if it is determined a smaller buffer may be appropriate. Prescribed fire may occur in the WIZ, but direct ignition would not occur in these zones. Pile burning would not be allowed in the WIZ.

27. If boreal toad breeding sites are discovered during the life of this project, a 300 foot no treatment buffer would be put in place surrounding the breeding ponds. A map of known locations would be provided by the District Wildlife Biologist.
28. All project activities would be conducted in accordance with the guidance contained in the Watershed Conservation Practices Handbook guidelines (USDA Forest Service 2006, FSH 2509.25). The following Management Measures would be applicable to this project.
- MM9_1g. Avoid ground skidding on sustained slopes steeper than 40 percent and on moderate to severely burned sustained slopes greater than 30 percent. Conduct logging to disperse runoff as practicable.
 - MM12_1a. Site-prepare, drain, decompact, re-vegetate, and close temporary and intermittent use roads and other disturbed sites within one year after use ends (all treatments). Provide stable drainage that disperses runoff into filter strips and maintains stable fills. Stockpile topsoil where practicable to be used in site restoration. Use certified local native plants to re-vegetate as practicable; avoid persistent or invasive exotic plants.
 - MM12_1b. Remove all temporary stream crossings (including all fill material in the active channel), restore the channel geometry, and re-vegetate the channel banks using certified local native plants as practicable; avoid persistent or invasive exotic plants.
29. Before heavy equipment and vehicles would be allowed to cross streams, the Forest Fisheries Biologist and/or Hydrologist would be consulted to determine where crossings would occur or be constructed, and to specify any stipulations necessary to minimize negative impacts on aquatic resources.. These restricted periods would be determined by the Fisheries Biologist prior to project implementation and best management practices would be followed to minimize disturbance and sedimentation to spawning fish and incubating eggs.
30. The following soil, water, riparian, and aquatic resource design criteria are specific to the Halfmoon Creek Watershed Restoration and Habitat Improvement Project. These criteria are based on the Forest Plan Standards and Guidelines (USDA Forest Service 1984), *Region 2 Watershed Conservation Handbook* (USDA Forest Service 2006, FSH 2509.25), Section 402 and 404 of the Clean Water Act (33 USC 1342 and 1344), and recommendations from Colorado Parks and Wildlife.
- Do not modify or dam the river in ways that would cause water levels to exceed bankfull elevations.
 - Restore any channel changes to hydraulic geometry standards for each stream type.
 - Re-vegetate to 80 percent ground cover within one year of disturbance using native vegetation.
 - Prevent hazardous substance spills by refueling and maintaining equipment outside of the water influence zone and by properly storing and handling materials.
 - Keep vehicles on established roads and pullouts. Clean all equipment prior to entry in the river to help prevent the spread of aquatic invasive species.

- Whole trees and other wood utilized for aquatic habitat enhancement would be harvested using techniques developed by the Pike and San Isabel National Forests on the South Platte River to limit soil disturbance and promote vegetation regrowth (Trees for Trout Initiative 2005-2012).

FIRE/FUELS

31. Where possible, avoid additional mechanical treatments after prescribed fire (broadcast burning) treatments occur.
32. Pile size:
 - Hand piles max size: 10 feet x 10 feet x 8 feet (height)
 - Machine piles max size: 30 feet x 30 feet x 20 feet (height) with use of brush rake
 - Machine piles max size: 20 feet x 20 feet x 12 feet (height) with use of blade

BOTANY

33. Prior to implementation, surveys for Selkirk's violet and Weber's draba would be done during June and July near streams that may be impacted. Surveys for moonworts would be done from June through August along roadsides that may be disturbed during project implementation. If Weber's draba are located, all sites including a minimum 100 feet buffer would be avoided and protected. If Selkirk's violet or moonworts are found, the sites would be avoided and protected. The Forest Botanist would determine the buffer and mark the area prior to implementation of ground disturbing activities.

NOXIOUS WEEDS

34. To reduce risk of spreading noxious weeds, all heavy equipment and vehicles would be cleaned and inspected prior to entering the National Forest and all mud, dirt, and plant parts would be removed according to Region 2, Guide to Noxious Weed Prevention Practices (USDA Forest Service 2001).
35. Treatment areas would be monitored pre- and post-treatment (two years post-project completion) for noxious weeds. Weed locations identified would be scheduled for treatment by the Noxious Weed Coordinator.
36. Only certified weed-free Forest Service approved native grass/forb seed mixes would be used for re-vegetation efforts.
37. All noxious weed treatments would be in compliance with the PSICC Forest Plan, Invasive Species Environmental Assessment (1998), 2013 Management of Noxious Weeds Biological Assessment, and PSICC Invasive Species Strategic Plan (2008 – 2010). In addition, areas located on the Pike and San Isabel National Forests have an approved Pesticide Discharge Management Plan with the Environmental Protection Agency for treatment of noxious weeds in Tier 3 waters.

ROADS

38. Lake County Roads 4, 9, 9A, 9C and 11 are closed during the winter months (generally this is from mid-November to the first of May) to normal vehicle traffic. Exceptions to these

closures, in order to access and haul from the project area, would be coordinated with the Lake County Board of County Commissioners annually prior to the winter season. Exceptions to the closures would be limited in scope and time.

39. Snow removal would be done in a manner to preserve and protect the roads to insure safe and efficient transportation and to prevent unacceptable erosion damage to roads, streams, and adjacent lands. Where possible, snow would not be removed to the road surface. A minimum 2 inch depth would be left to protect the roadway.
40. Equipment would not be operated when the ground is muddy or the soil moisture is high enough for equipment to leave ruts over 3 inches in depth.

VISUAL QUALITY MANAGEMENT

41. Paint only trees to be cut, paint side away from improvements, and use the minimum paint necessary to meet contract specifications within the first 100 feet of sensitive scenic areas. Sensitive scenic areas within the project area are: CDNST, Colorado Trail, Top of the Rockies Scenic Byway, and developed recreation sites including campgrounds and day use areas.
42. Cut stumps 6 – 8 inches from the ground within 100 feet of sensitive scenic areas. Sensitive scenic areas within the project area are: CDNST, Colorado Trail, Top of the Rockies Scenic Byway, and developed recreation sites including campgrounds and day use areas.
43. Flush cut stumps in developed recreation sites (exceptions include stumps located in rocky areas or areas that may pose a hazard to the sawyers).
44. No slash would be piled within 50 feet from trails and roadways to minimize visual impacts along these routes.

CDNST

45. Prior to implementation of clear cut units, the District Visual Quality Monitor would be consulted to assist in determining clear cut locations and ensuring Visual Quality Objectives (VQO) are met. The District Visual Quality Monitor would utilize the following information: a Visual Quality Objective of Partial Retention would be maintained within the foreground (0 – ½ mile) and middleground (½ - 4 miles). The VQO applies only to areas seen from the trail (this includes areas of the trail outside the project area). Based on the Partial Retention objective, treatment activities may repeat the form and line common to the characteristic landscape. Treatment activities may also introduce form and line characteristics not found in the landscape. However, changes in the qualities of size, amount, intensity, direction, and pattern shall remain visually subordinate. Duration of visual impacts: Reduction in form, line, color, and texture should be accomplished as soon as possible or at a minimum within the first year (USDA Forest Service 1974, pp. 32-33).
46. Existing opening as seen from the CDNST may be expanded up to 1/3 the size of the openings but would not exceed 40 acres (existing open + clear cut unit = 40 acres).
47. Feather thinning treatments that occur along the CDNST in dense forest stands. Feathered treatments would include: limited thinning in the first 50 feet from the trail and a gradual increase in thinning in the next 100 feet. Full thinning objectives would occur 150 feet and greater from the trail. Prior to implementation of thinning treatments, the District Visual Quality Monitor would be consulted to assist in determining locations and ensuring Visual Quality Objectives (VQO) are met. The District Visual Quality Monitor would utilize the

following information: a Visual Quality Objective of Partial Retention would be maintained within the foreground (0 – ½ mile) and middleground (½ - 4 miles). The VQO applies only to areas seen from the trail (this includes areas of the trail outside the project area). Based on the Partial Retention objective, treatment activities may repeat the form and line common to the characteristic landscape. Treatment activities may also introduce form and line characteristics not found in the landscape. However, changes in the qualities of size, amount, intensity, direction, and pattern shall remain visually subordinate. Duration of visual impacts: Reduction in form, line, color, and texture should be accomplished as soon as possible or at a minimum within the first year (USDA Forest Service 1974, pp. 32-33).

SAFETY

48. Forest Service would consult with Xcel Energy prior to any treatments occurring adjacent to high voltage power lines.

SKI COOPER SKI AREA ONLY (WHITE RIVER NATIONAL FOREST ONLY)

49. Yarding or the removal of large material (greater than 8 inches in diameter) would be required for spruce.
50. Spruce logs at the landings would be removed before spruce beetles emerge (emergence period is May - July).
51. Advanced regeneration (less than 5 inches in diameter) would be protected to the extent feasible.

Alternatives Considered but not Analyzed in Detail _____

An alternative was considered to include portions of the Colorado Roadless Areas located adjacent to the current project boundary. The thought was to include all areas where forest management could occur. The Interdisciplinary Team decided against including the Colorado Roadless Areas due to issues with accessibility, the amount of temporary roads needed to access the area, and the lack of public support.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2.9 Comparison of Alternatives by Acres

ACTIVITIES	No Action Alternative	Alternative 1 (Proposed Action)	Alternative 2
Create openings through prescribed fire and mechanical means in lodgepole pine	0 ac	2,370 ac	3,790 ac
Mechanical thinning lodgepole pine stands including pre-commercial thinning	535 ac	7,110 ac	3,030 ac
Total treated acres of lodgepole pine	535 ac	9,480 ac	6,820 ac
Improve health of aspen stands	0 ac	115 ac	180 ac
Prescribed fire in lodgepole pine thinning areas	115 ac	1,778 – 3,555 ac	758 – 1,515 ac
Prescribed fire in lodgepole pine openings	0 ac	2370 ac	3790 ac
Prescribed fire in aspen	0 ac	115 ac	180 ac
Total acres of prescribed fire	115 ac	4,263 – 6,040 ac	4,728 – 5,485 ac

Table 2.10 Comparison of Alternatives by Effects

EFFECTS	No Action Alternative	Alternative 1 (Proposed Action)	Alternative 2
Reduce impacts from mountain pine beetle infestation	0 ac	9,475 ac (85% of lodgepole pine)	6,822 ac (61% of lodgepole pine)
Effective treatments for dwarf mistletoe	< 470 ac	60 – 65% of infected area	90 – 100% of infected area
Promote age class and species diversity	0 ac	2,370 ac	3,790 ac

Monitoring

Forest Service specialists would perform monitoring throughout the implementation of this project to ensure Best Management Practices and design criteria are adhered to. The monitoring would occur as follows:

Wildlife

- The District personnel would monitor for nesting raptors including nesting Northern goshawks.
- District personnel would monitor for dense horizontal cover utilizing cover boards.
- Pellet sampling would be conducted in some pre-commercial thinning units to determine snowshoe hare use.
- Game camera sets may be used to determine wildlife use throughout the project area.
- District personnel would periodically monitor treatment units to ensure snag and coarse woody debris requirement are being met.
- Monitoring strategies for snowshoe hare, the primary prey species for Canada lynx, would be developed and implemented with the direction and cooperation of Colorado Parks and Wildlife. The most recent techniques and methods practical and feasible for monitoring at the project level scale would be implemented.
- In stream structures placed in Halfmoon Creek would be monitored annually for five years after implementation is complete.

Cultural Resources

- Monitoring of historic properties during and after project implementation may be determined necessary by the Zone Archeologist.
- In the event that cultural resources are discovered, all activities in the immediate area would stop and the Zone Archeologist would be notified immediately. Work would not resume in that area until the Zone Archeologist has coordinated with the District Ranger and work has been authorized to continue.

Fire and Fuels

- Monitoring of prescribed fire would include fire weather, fuel moisture, and smoke dispersal to ensure these activities are conducted within the prescription parameters stated in the burn plan.

Noxious Weeds

- District and Forest personnel would monitor noxious weed infestations before, during, and after project implementation. Treatments would be done as needed.

Regeneration Surveys

- Regeneration surveys would be completed for regeneration harvests three and five years post-harvest to measure success of natural regeneration and assess the need for planting to assure compliance with the National Forest Management Act and the Forest Plan.

Soil and Water

- District personnel would monitor ground disturbing activities including: construction of temporary roads, stream – temporary road crossings, skid trails, and landings to ensure that best management practices (BMPs) are being adhered to.
- District personnel would monitor mud depth. Operations would be shut down if operating equipment would cause ruts over 3 inches in depth.
- Pebble count would be utilized to monitor stream channels within the project area.

CDNST

- District Visual Quality Monitor would monitor to ensure Visual Quality Objectives (VQO) are met for treatments adjacent to and as seen from the CDNST.

CHAPTER 3 – ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter presents information about current resource condition of the project area and the direct, indirect, and cumulative effects of implementing each alternative. The information presented in this chapter summarizes and cites the specialist reports that are found in the project record.

The effects disclosed have considered the effectiveness of the design criteria outlined in Chapter 2. Each resource area discloses the direct, indirect, and cumulative effects for that resource area. The National Environmental Policy Act defines these effects as:

Direct Effects – caused by the action and occur at the same time and place

Indirect Effects – caused by the action but occur later in time or further removed in distance, but are still reasonably foreseeable

Cumulative Effects – those that result from the incremental impacts of the action when added to other past, present, and reasonable foreseeable actions

The project Interdisciplinary Team identified past, present, and reasonably foreseeable future actions that might have cumulative impacts with the proposed action. Each resource area considered different mixes of these actions, depending on the cumulative effects boundary for the resource area and resource affected.

Only those past, present and reasonably foreseeable actions that overlap the geographic analysis area boundary for each particular resource area are considered, and only if those other actions are expected to have overlapping effects with the Tennessee Creek Project. Some past actions may still be having effects on one resource, but not another.

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the modified proposed action or adaptive management strategy. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Focusing on the impacts of past human actions would risk ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to

capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The suite of present and reasonably foreseeable future action developed by the project Interdisciplinary Team and examined for overlapping effects for each resource in the Tennessee Creek project area are:

Present Actions

- Vegetation management (i.e., thinning, group selection, patch cuts, chipping of slash, and fuelwood) within the foot print of the campgrounds and developed sites at Halfmoon Creek and Turquoise Lake would continue. A vegetation management plan is in place for the developed sites. Annual treatments average 7 – 10 acres per year.
- Hazard tree removal at developed sites and Ski Cooper would continue as needed.
- Hazard tree removal along Forest system trails and roads would continue as needed.
- Northwest Leadville Hazardous Fuel Project would continue. Treatments would include pre-commercial thinning, group selection, thinning of mature stands, broadcast burning, and pile burning. Annual treatments average 10 – 20 acres per year.
- Using Forest Plan Direction, continue to improve and rehabilitate the area adjacent to Halfmoon Creek (within 100 feet of the creek). Treatments include using boulders and buck and rail fence to restrict access and seeding to re-vegetate areas.
- Rehabilitate non-system routes.
- Monitor and treatment of noxious weeds.
- Regular maintenance of Forest system trails and roads.
- Recreation activities as authorized including snowmobiling, Nordic and alpine skiing, OHV use, biking, and hiking.
- Outfitter and guide activities and other special events as permitted.

Activities on lands other than Forest Service

- Timber harvest and fuels reduction on private lands.
- Development on private lands.
- Special events, such as bike races, on county roads.
- Small scale timber sales on Bureau of Land Management (BLM) lands.

Reasonably Foreseeable Activities

- Potential future wildfire.
- Timber harvest and fuels reduction on private lands.

- Development on private lands.
- Noxious weed monitoring and treatments.
- Regular maintenance of Forest system trails and roads.
- Recreation activities as authorized including: snowmobiling, Nordic and alpine skiing, OHV use, biking, and hiking.
- Outfitter and guide activities and other special events as permitted.
- BLM Vegetation Manipulation Management: Chaffee and Lake County planning.
- Collection of fuelwood and post and pole material.

Vegetation ---

EXISTING CONDITION

GENERAL VEGATION INFORMATION

A total of 13,837 acres of the 16,450 project area acres are forested. The forested landscape of the Tennessee Creek project area is dominated by lodgepole pine forests. The lodgepole pine type covers 80 percent of the forested area within the project boundary. Spruce-fir (15 percent) and aspen (4 percent) are the other forest types represented on 500 or more acres. Minor amounts of blue spruce, bristlecone pine, and Douglas-fir each comprise less than 1 percent of the forested area. The remaining 2,611 acres area non-forested and are comprised of a variety of shrub and grass-like vegetation communities.

The forested landscape is generally middle-aged to mature forests with an average age of approximately 125 years. There is a relatively uniform mix of stand ages across the project area. This uniform mix is derived from the large regeneration event in the late 19th and early 20th centuries. Extensive logging for mine timbers, charcoal, and general wood use followed by wildfire regenerated a large portion of the project area in a relatively short period of time. Today, the results of these past events are large expanses of generally even-aged lodgepole pine stands across the project area. As the forests have aged since the late 1800's and early 1900's the risk of mortality from insect and disease across the landscape has increased. At this time 85 percent of the lodgepole pine stands in the project area have physical stand characteristics that place them in the moderate to high range for mountain pine beetle risk. Stand basal areas and average tree diameter have steadily increased over time and have crossed thresholds that lead to a higher risk of widespread pine beetle mortality. Dwarf mistletoe has increased across the landscape as well, with 40 percent of the stands showing the presence of mistletoe. Current stand conditions are conducive to additional mistletoe spread.

Over time the risk for mountain pine beetle outbreaks will continue to climb and dwarf mistletoe will continue to spread. As the lodgepole pine stands in the project area continue to grow, basal areas and average tree diameter will continue to increase. These conditions provide habitat that is more susceptible to mountain pine beetle outbreaks. Stands with basal areas and average diameters that point to low risk will grow to moderate risk and, consequently, moderate risk stands to high risk

over time. Absent a large scale disturbance such as fire or vegetation management, mountain pine beetle risk and dwarf mistletoe infection will continue to increase for the foreseeable future.

The aspen and spruce-fir forests have similar age class distributions to the lodgepole pine type. The incidence of insect and disease for these forests types is low at this time. Spruce-fir and aspen stands have increased risk for forest insects and disease as they age. Over time and in the absence of disturbances such as fire and vegetation management many aspen stands are encroached by and eventually replaced by conifers. Regeneration of aspen by fire or vegetation management allows aspen to persist on the site for longer period of time.

The spruce-fir type persists for several centuries on a site with no disturbance. The main threat to mature spruce forests comes from spruce beetle (*Dendroctonus rufipennis*) infestations. Spruce beetle risk is highest in larger, denser spruce forests on cool moist aspects. Age class diversity plays a large role in managing spruce beetle risk as younger, smaller diameter stands are at less risk.

EXISTING CONDITION

Information for this section is derived from the existing Forest Vegetation Geographic Information System (GIS) layer. Additional site specific information has been collected on approximately 300 stands in the project area during various stand exam efforts over the last eight years. Vegetation structural stage and cover type for this report are derived from the existing Forest Vegetation layer in GIS. Site specific stand characteristics such as dwarf mistletoe presence and intensity, basal area, and trees per acre are estimates from the current collection of stand exam data and are extrapolated to the project area.

Across the project area the GIS vegetation layer indicated 16 cover types within the Tennessee Creek project area. The cover types and total acres per type are summarized in Table 3.1.

Table 3.1 Acres by Cover Type for Entire Project Area

Cover Type	Acres		Cover Type	Acres
Lodgepole pine	11,096		Water	47
Spruce-fir	2,117		Sedge	46
Grass	1,329		Alder	29
Aspen	564		Blue Spruce	25
Forbs	485		Douglas-fir	24
Willow	405		Sage	16
Barren	132		Bristlecone	11
Rock	104		Fescue	1

In order to simplify existing condition discussion the cover types will be consolidated into 7 groups. The groups and acres are summarized in Table 3.2.

Table 3.2 Groups by Cover Type and Group Acres

Group Name	Cover Types	Group Acres
Lodgepole pine	Lodgepole pine	11,096
Spruce-fir	Spruce-fir Douglas-fir Bristlecone pine Blue Spruce	2,177
Grass	Grass Forbs Fescue Sedge	1,861
Aspen	Aspen	564
Shrub	Willow Alder Sage	450
Rock	Rock Barren	236
Water	Water	47

The water group will not be discussed further in this report. All other groups will be discussed in varying degrees of intensity.

Lodgepole Pine

Lodgepole pine is the dominant vegetation cover type across the project area. Stands classified as lodgepole pine encompass 11,096 or 67 percent of all cover types in the project area. A total of 380 stands are classified as lodgepole pine within the project area. Stand size ranges from less than 1 acre to 320 acres. Basal areas vary across the landscape from as low as 60 BA to over 280 BA, with an average of 120 BA. The average trees per acre is 430 for trees greater than 1.0 inch DBH with an average diameter at breast height (DBH) of 7.7 inches. Lodgepole pine dwarf mistletoe (*Arceuthobium americanum*) is present across the landscape with 40 percent of stands that have had stand exams showing mistletoe infection. Forested stands can be broken down into 5 Vegetation Structural Stages (VSS) based on tree diameter. VSS 3, 4 and 5 can be broken down further into sub-classes based on crown cover percentage. Old growth for lodgepole pine is generally defined as stands greater than 150 years old (Mehl, 1992). The majority of stands in the project area were regenerated during the last decades of the 19th Century and are less than 150 years old. The following table outlines the parameters for various structural stages and crown cover classes.

Table 3.3 Region 2, Rocky Mountain Resource Inventory System (RMRIS) Database Vegetation Structural Stage

Code	Habitat Structural Stage	Tree Size Class	Diameter Range	Crown Cover %
1	Grass-forb	Non-stocked	NA	0-10
2	Shrub/seedling	Established	Less than 1 inch	11-100
3A	Sapling-pole	Small, medium	Trees mostly 1-9 inch	11-40
3B				41-70
3C				71-100
4A	Mature	Large, very large	Trees mostly 9 inches and larger	11-40
4B				41-70
4C				71-100
5A	Old-growth	Large, very large	Varies	11-40
5B				41-70
5C				71-100

Based on the vegetation GIS layer of the lodgepole pine type within the project area the current VSS are represented in Table 3.4. Several assumptions were made to derive this information. All of the acres in VSS 1 were derived from vegetation types different than lodgepole as the definition of VSS 1 is non-stocked but previously treed. For example, a grass cover type stand classified as VSS 1T, with the “T” indicating that the stand was previously treed would actually represent VSS 1 for lodgepole pine.

Table 3.4 Percentage of Lodgepole by VSS in the Project Area

Vegetation Structural Stage	Percentage of Lodgepole Pine
VSS 1	3.89%
VSS 2	0.44%
VSS 3	67.17%
VSS 4	28.50%

Spruce-Fir

The spruce-fir type is the second largest vegetation cover type in the project area covering 2,177 acres or approximately 13 percent of the project area. This vegetation type consists of stands dominated by Engelmann spruce (*Picea engelmannii*) and sub-alpine fir (*Abies lasiocarpa*). This cover type includes minor amounts of Douglas-fir (*Pseudotsuga menziesii*), bristlecone pine (*Pinus aristata*) and blue spruce (*Picea pungens*) stands. A total of 96 stands are classified as spruce-fir within the project area. Stand size ranges from less than 1 acre to 141 acres. Old growth for spruce-fir is generally defined as stands greater than 200 years old (Mehl, 1992). The majority of stands in the project area were regenerated during the last decades of the 19th Century and are less than 200 years old. Basal areas vary across the landscape from as low as 20 BA to over 240 BA with an average of 118 BA. The average trees per acre is 296 for trees greater than 1.0 inch DBH with an average diameter of 8.5 inches. Insect and disease occurrence is at low levels in this vegetation type within the project area at this time. Current data shows no acreage in VSS 1 or 2 for the spruce-fir cover type.

Table 3.5 Percentage of Spruce-Fir by VSS in the Project Area

Vegetation Structural Stage	Percentage of Spruce-Fir
VSS 3	15.0%
VSS 4	85.0%

Aspen

The aspen type is the fourth largest vegetation cover type in the project area covering 564 acres or approximately 3 percent of the project area. This vegetation type consists of stands dominated by aspen (*Populus tremuloides*). A total of 44 stands are classified as aspen within the project area. Stand size ranges from less than 1 acre to 55 acres. Basal areas vary across the landscape from as low as 49 BA to 176 BA with an average of 130 BA. The average trees per acre is 539 for trees greater than 1.0 inch DBH with an average diameter of 6.6 inches. Insect and disease occurrence is low for the aspen in the project area at this time.

Table 3.6 Percentage of Aspen by VSS in the Project Area

Vegetation Structural Stage	Percentage of Aspen
VSS 3	11.6%
VSS 4	88.4%

Grass

The grass cover type is the third largest vegetation cover type in the project area covering 1,861 acres or approximately 11 percent of the project area. This cover type group consists of stands classified in the forest cover type layer in GIS as grass, forb, and fescue. A total of 193 stands are classified as grass within the project area. The breakdown of acres within this type is grass 1,280 acres, forb 268 acres, and fescue 1 acre. Stand size ranges from less than 1 acre to 60 acres. In terms of VSS all grassland cover types fall into VSS 1 by definition. The difference in grass cover types are whether or not the acres were previously treed or are perennial grassland types.

Shrub

The shrub cover type encompasses 450 acres or approximately 3 percent of the project area. This cover type group consists of stands classified in the forest cover type layer in GIS as willow (*Salix spp.*), alder (*Alnus incana*) and sage (*Artemisia spp.*). A total of 46 stands are classified as shrub within the project area. The breakdown of acres within this type is willow 405 acres, alder 29 acres, and sagebrush 16 acres. Stand size ranges from less than 1 acre to 47 acres. In terms of VSS all shrub cover types fall into VSS 2 by definition and all are classified under the "S" sub class indicating perennial shrub cover types.

Rock

The rock cover type encompasses 236 acres or approximately 1 percent of the project area. This cover type group consists of stands classified in the forest cover type layer in GIS as rock and rock soil. A total of 22 stands are classified as rock within the project area. The breakdown of acres within this type is rock 132 acres and rock/soil 104 acres. Stand size ranges from less than 1 acre to 34 acres. In general rock cover types are not classified in any VSS unless they were previously treed. The project area contains 51 acres of the rock cover type that are classified as VSS 1T indicating that

they were previously treed. These acres have been included under lodgepole pine cover type VSS 1 for this report.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

Under the No Action Alternative vegetation management treatments would continue under the Northwest Leadville Hazardous Fuels (NWHF) Categorical Exclusion (CE) that treats 750 acres of lodgepole pine through thinning and small patch cuts as well as associated prescribed pile and broadcast burning. Developed recreation sites within the project area would continue to have hazard tree and mistletoe reduction work performed as needed. Outside of the above mentioned treatments, forested stands in the project area would continue to age and grow, resulting in greater tree density in terms of basal area per acre and trees per acre, increased intensity and footprint of dwarf mistletoe infection in lodgepole pine, and continued encroachment of conifer species into aspen stands and open areas. Mountain pine beetle risk across the project area would continue to increase due to increased stand density and increased average stand diameter.

In relation to the purpose and need and objectives of the project, the No Action Alternative has only minor impacts to the forested vegetation based on future treatments under the NWHF CE and future treatments in developed recreation sites. The amount of additional treatments anticipated to be completed under these treatments is approximately 550 acres. This is insignificant to all but the localized areas where these treatments will take place. Small amounts of age and species class diversity will be created, some mistletoe treatments will be completed and limited thinning will take place to reduce susceptibility to mountain pine beetle infestation. The main driver of vegetation conditions under the No Action Alternative will be the continuation of the trends that are already in place and described above.

The primary stand attributes for mountain pine beetle risk in lodgepole pine are average DBH and density in basal area per acre. Elevation is also a component in several risk rating systems (Amman 1977; Randall and Tensmeyer 2000) as well. In the past, elevation and associated harsher climatic conditions were believed to place elevation and latitude caps on mountain pine beetle habitat and subsequent risk of lodgepole pine mortality. Recent research (Tishmack and others 2005; Logan and Powell 2001 and 2004) has shown that bark beetles in general are operating successfully and causing widespread mortality at elevations and latitudes that were thought of as low risk in the past.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 1 (PROPOSED ACTION)

Lodgepole Pine

Alternative 1 proposes to treat up to 25 percent of lodgepole pine with clearcuts up to 40 acres, while thinning the remaining lodgepole cover type to a residual basal area of 80 – 120 square feet per acre. These treatments would lower the mountain pine beetle risk for lodgepole pine.

By clearcutting and regenerating lodgepole pine in the currently VSS 3 & 4 and at higher risk for mountain pine beetle infestation, the overall risk for the project area would be reduced. Regenerated lodgepole pine stands are at very low risk for mountain pine beetle infestation for 60 – 80 years after they are regenerated due to the small diameters of the regenerated stands (Amman

1977). In approximately 60 – 80 years the regenerated clearcuts would begin to attain the minimum size to become available as host material for mountain pine beetle. The result of the clearcut treatment would be to essentially eliminate the mountain pine beetle risk on 2,368 acres or 25 percent of the treatable lodgepole pine acres for the next 60 – 80 years. Clearcutting is the most effective route to rapid and successful regeneration in lodgepole forests (Koch 1996). The clearcuts would also be designed to promote aspen where possible thereby creating species composition that is not a host for mountain pine beetle.

Alternative 1 would treat a maximum of 7,107 acres of lodgepole pine by thinning to reduce basal area to an average of 80 – 120 square feet per acre. Currently, approximately 85 percent of the lodgepole pine stands in the project have basal areas above 80 square feet per acre which is considered the threshold for moderate risk. Reducing basal areas to the level described above would reduce the stands risk of mountain pine beetle infestation. Sufficient evidence exists that forest management can reduce mortality from bark beetles and create conditions that reduce the susceptibility of stands to infestation (Fettig et. al. 2007). Thinning treatments would be designed to promote other species (e.g., aspen, spruce, and fir) that are non-host species for mountain pine beetle, further reducing the stand risk for mountain pine beetle.

The combination of thinning and clearcutting proposed under Alternative 1 would reduce the risk of mountain pine beetle infestation on approximately 9,475 acres (85 percent) of the 11,096 of lodgepole pine in the 16,448 project area. Clearcuts would promote age class and species diversity on 2,368 acres.

An additional forest health concern within the project area is the abundance of dwarf mistletoe infection in lodgepole pine. Dwarf mistletoe is present in approximately 40 percent of the stands in the project area according to the stand exam data collected for the project. Dwarf mistletoe has the effect of reducing stand growth, increasing infected tree mortality, and leading to a higher crown fire risk due to fuel loading and canopy bulk density. Clearcutting on 25 percent of the project area would allow heavily infected mistletoe stands to be regenerated to mistletoe free stands. Newly regenerated lodgepole pine stands develop mistletoe free. Newly regenerated stands may also contain non-host tree species further reducing the long term susceptibility to infection. In general thinning is not a highly effective treatment for reducing mistletoe infection as thinning treatments can accelerate the speed at which additional areas are infected and the unharvested trees continue to be infected. Thinning treatments designed to promote non-host trees species and incorporate small group openings may allow the thinning treatments to be effective at reducing lighter mistletoe infections but the best treatment for heavier infections is clearcutting.

In general, the clearcutting treatments proposed in Alternative 1 would lead to a reduction in the area of dwarf mistletoe infection in the project area. The amount of the reduction would depend in large part on the distribution of mistletoe across the landscape and the placement of clearcuts in the project area. The best scenario would be to place the clearcuts in areas of heavy mistletoe infection that have the ability to regenerate to aspen and other non-host tree species. Under this scenario up to 25 percent of the project area can be regenerated to stands free of mistletoe infection.

Overall, Alternative 1 treats the highest percentage of lodgepole pine stands in the project area. In general, all acres would have the opportunity to experience a reduction in mountain pine beetle risk

while effective treatments for dwarf mistletoe reduction would likely be limited to 60 – 65 percent of the infected area.

Alternative 1 would allow for 25 percent of the lodgepole pine acres to have treatments that would promote age class and species diversity through clearcutting. Clearcutting would meet the objectives of promoting age class and species diversity for lodgepole pine. Due to the average age of the lodgepole pine type of approximately 125 years, Alternative 1 would likely not lead to a successful transition of the lodgepole pine type to be managed to a rotation age of 150 years. Regenerating 25 percent of the lodgepole pine stands would take an inadequate amount of time to reach a normal forest of balanced age classes. With 95 percent of the lodgepole pine type concentrated in VSS 3 and 4, clearcutting 25 percent at this time would result in 70 percent of the project area remaining in VSS 3 and 4 after treatment. Assuming the next entry being in 20 – 30 years the average stand age would be greater than 150 years for the 50 percent of stands remaining after the next entry. Under this scenario it would take an additional 75 years to reach a normal forest comprised of an even distribution of age classes requiring a rotation of greater than 200 years for many stands, resulting in high ratings for mountain pine beetle stands. Alternative 1 meets the purpose and need of the project for up to 20 – 30 years.

Aspen

The aspen cover type comprises 455 acres within the project area. Alternative 1 proposes to clearcut and regenerate 25 percent of the aspen acres in the project area.

The current VSS of aspen in the project area is all VSS 3 and 4 with no VSS 1 or 2. Younger aspen stands are less susceptible to a range of forest pathogens. As an early seral species, aspen requires periodic disturbance events and regeneration to maintain its occupancy of a particular site. In the absence of disturbance, aspen is often replaced by more shade tolerant conifers. Clearcutting 25 percent of the aspen in the project would be a good step to maintain aspen dominance of certain sites. Additional treatments that stimulate aspen reproduction and increase aspen on the landscape would help to promote aspen across the project area, often at the expense of lodgepole pine, thereby helping to break up the continuity of lodgepole dominated stands and reduce mountain pine beetle risk.

Due to its status as an early seral species and shorter life spans, treating only 25 percent of the aspen type through regeneration cutting would lead to silvicultural issues similar to the lodgepole type and rotation length. The rotation length issue would partly be ameliorated by the design of treatments in the lodgepole pine type that promote aspen. This should lead to additional stands being regenerated to aspen and a better balancing of the age classes over time.

Spruce-Fir

Treatments for the spruce-fir type are the same under both Alternative 1 and 2 and will be discussed in a separate section.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 2**Lodgepole Pine**

Alternative 2 proposes to treat up to 40 percent of lodgepole pine with clearcuts up to 40 acres. Thinning in the lodgepole cover type to a residual basal area of 80 – 120 square feet per acre would be limited to 3,032 acres around Turquoise Lake, ditches associated with water rights, and areas within the wildland urban interface only. These treatments would lower the mountain pine beetle risk for lodgepole pine.

By clearcutting and regenerating lodgepole pine in the currently VSS 3 and 4 and at higher risk for mountain pine beetle infestation the overall risk for the project area would be reduced. Regenerated lodgepole pine stands are at very low risk for mountain pine beetle infestation for 60 – 80 years after they are regenerated due the small diameters of the regenerated stands. In approximately 60 – 80 years the regenerated clearcuts would begin to attain the minimum size to become available as host material for mountain pine beetle. The result of the clearcut treatment would be to essentially eliminate the mountain pine beetle infestation risk on 3,790 acres or 40 percent of the treatable lodgepole pine stands for the next 60 – 80 years. The clearcuts would also be designed to promote aspen where possible thereby creating a stand species composition that is not a host for mountain pine beetle, further reducing the stand risk for mountain pine beetle.

Alternative 2 would treat 3,032 acres of lodgepole pine by thinning to reduce basal area to an average of 80 – 120 square feet per acre. Currently, approximately 85 percent of the lodgepole pine stands in the project have basal areas above 80 square feet per acre; this is considered the threshold for moderate risk. Reducing basal areas to the level described above would reduce the stands risk of mountain pine beetle infestation. Thinning treatments would be designed to promote other species (e.g., aspen, spruce, and fir) that are non-host species for mountain pine beetle further reducing the stand risk for mountain pine beetle.

The combination of thinning and clearcutting proposed under Alternative 2 would reduce the risk of mountain pine beetle infestation on approximately 6,822 (61 percent) of the 11,096 acres of lodgepole pine in the 16,448 project area. Clearcuts would promote age class and species diversity on 3,790 acres.

An additional forest health concern within the project area is the abundance of dwarf mistletoe infection in lodgepole pine. Dwarf mistletoe is present in approximately 40 percent of the stands in the project area according to the stand exam data collected for the project. Dwarf mistletoe has the effect of reducing stand growth, increasing infected tree mortality and leading to a higher crown fire risk due to fuel loading and canopy bulk density. Clearcutting on 40 percent of the project area would allow most of the dwarf mistletoe stands to be regenerated to mistletoe free stands. Newly regenerated lodgepole pine stands develop mistletoe free. Newly regenerated stands may also contain non-host tree species further reducing the long-term resistance of the stands to infection. In general thinning is not a highly-effective treatment for reducing mistletoe infection as thinning treatments can accelerate the speed at which additional areas are infected and the unharvested trees continue to be infected. Thinning could be used almost exclusively in mistletoe-free stands and be used to lower basal areas specifically for reduction of the mountain pine beetle risk.

In general, the clearcutting treatments proposed in Alternative 2 would lead to a reduction in the area of dwarf mistletoe infection in the project area. The amount of the reduction would depend in

large part on the distribution of mistletoe across the landscape and the placement of clearcuts in the project area. Under this alternative, dwarf mistletoe would be greatly reduced across the landscape and have much less influence on stand development than under Alternative 1.

Overall, Alternative 2 treats a smaller percentage of lodgepole pine stands in the project area but has the ability to better address dwarf mistletoe issues than Alternative 1 and promotes lower risk for mountain pine beetle by treating a larger portion with clearcuts. The effectiveness of mountain pine beetle treatments is split. While clearcuts and regeneration of stands provide better and longer lasting reduction of mountain pine beetle risk, the reduction in thinning acres means that 2,655 less acres would be treated in the lodgepole pine type resulting in no change from current mountain pine beetle risk. In general for Alternative 2, approximately 60 – 65 percent of lodgepole pine acres would have the opportunity to have a reduction in mountain pine beetle risk while effective treatments for dwarf mistletoe reduction may approach 90 – 100 percent of the infected area.

Alternative 2 would allow for 40 percent of the lodgepole pine acres to have treatments that would promote age class and species diversity through clearcutting. Clearcutting would meet the objectives of promoting age class and species diversity for lodgepole pine. Due to the average age of the lodgepole pine type of approximately 125 years, Alternative 2 is more likely to lead to a successful transition of the lodgepole pine type to be managed to a rotation age of 150 years. Regenerating 40 percent of the lodgepole pine stands would result in 55 percent of the project area remaining in VSS 3 and 4 after treatment. Assuming the next entry occurs in 20 – 30 years the average stand age would be greater than 150 years for some stands but there would be less regeneration needed in future entries to reach a balanced age class structure. Under this scenario it would take an additional 50 years to reach a normal forest comprised of an even distribution of age classes. Under this scenario the number of stands with required rotation ages of greater than 150 years would be reduced compared to Alternative 1, resulting in less long-term risk for mountain pine beetle infestation.

Aspen

The aspen cover type comprises 455 acres within the project area. Alternative 2 proposes to clearcut and regenerate 40 percent of the aspen acres in the project area.

The current VSS of aspen in the project area is all VSS 3 and 4 with no VSS 1 or 2. Younger aspen stands are less susceptible to a range of forest pathogens. As an early seral species aspen requires periodic disturbance events and regeneration to maintain its occupancy of a particular site. In the absence of disturbance aspen is often replaced by more shade tolerant conifers. Clearcutting 40 percent of the aspen in the project would be a good step to maintain aspen dominance of certain sites. Additional treatments that stimulate aspen reproduction and increase aspen on the landscape help to promote aspen across the project area, often at the expense of lodgepole pine, thereby helping to break up the continuity of lodgepole-dominated stands and reducing mountain pine beetle risk.

Due to its status as an early seral species and shorter life spans, treating 40 percent of the aspen type through regeneration cutting would lead to a better chance to achieve the silvicultural goal of a balance of age classes within the rotation age of 150 years. An additional benefit to a higher percentage of aspen clearcuts would be the ability of more aspen regeneration to be successful in outgrowing browsing pressure from big game.

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES**Spruce-Fir**

Certain vegetation management actions are common to both action alternatives. The proposed spruce-fir treatments state, “In the event spruce beetle or other insects and diseases impact spruce forests, the following treatments would be allowed: salvage of dead trees, removal of trees infested with beetles, and removal of green trees for skid trails, temporary roads or where residual trees will likely blow over after the removal of the infested or dead trees.” In essence these are salvage treatments that would be initiated upon the arrival of the spruce beetle and the initiation of beetle-induced mortality. There would be no treatment of current stands to reduce susceptibility of stands to spruce beetle infestation in the absence of a spruce beetle outbreak. Salvage treatments would address safety issues associated with an abundance of dead trees, provide economic recovery of beetle killed trees, and provide funding and opportunities to promote spruce regeneration through site preparation and planting of the spruce stands.

In the spruce-fir zone, the high elevation and short growing seasons result in sporadic and slow regeneration after disturbance. It can often take 30 – 40 years for naturally regenerated spruce seedlings to reach 4.5 feet (diameter at breast height). If successful, planting of spruce seedlings can lead to faster establishment of beetle killed stands where natural regeneration has not materialized. In the long run, spruce stands may be established sooner using artificial regeneration methods when compared to natural regeneration.

Lodgepole Pine – Pre-commercial Thinning

Pre-commercial thinning of approximately 350 acres of lodgepole pine plantations is proposed under both alternatives. Thinning of these younger stands would lead to more vigorous and faster growth of the young trees and a reduction of density dependent mortality events. In the long run, managed and more open stands are at reduced risk for mountain pine beetle infestation and produce larger size classes at a younger age than unmanaged stands. Thinning of the 350 acres of plantations would have long-term benefits for forest health and timber production goals.

Meadows and Sagebrush

The proposed treatments that remove conifer encroachment from sagebrush and meadows provide habitat benefits for wildlife that are dependent on these vegetation types as well as fuels reduction goals. There are forest health and silvicultural benefits to maintaining these areas as open. Removing lodgepole pine encroachment from sagebrush and meadows reduces the preponderance of lodgepole pine as the dominant vegetation type in the project area. If maintained as meadows these areas would not convert to lodgepole pine and become host areas capable of supporting mountain pine beetle and dwarf mistletoe. Maintaining open areas may provide for buffers to dwarf mistletoe spread from stand to stand. Overall these treatments would benefit the long-term forest health of the project area by maintaining open areas within the project area.

CUMULATIVE EFFECTS

The cumulative effects boundary for vegetation includes the project boundary plus the adjacent National Forest land and other ownership that would be included in the project were the project boundary contiguous in one single large polygon. In between the various non-contiguous portions of

the Tennessee Creek project area are vast stretches of National Forest System lands that are classified as Roadless and Wilderness. The area outside of the project area is nearly equal in size to the project area boundary and more than the treatable acres within the project. As described in other sections of the document, little vegetation management is currently taking place or expected to take place in the near future within the project area. Only minor treatments of approximately 550 (less than 2 percent of the project area) acres have occurred recently or are expected to occur with proposed or currently approved environmental analysis. On lands generally not subject to vegetation management activities, natural process driven by age, vegetation composition, climate, and other natural conditions would dominate.

Fire / Fuels

EXISTING CONDITION

Fire History

The local Fire Management Unit (FMU) that encompasses the project area has averaged 14 fires per year, excluding non-Federal lands, over the last 35 years. Approximately 1,550 acres of National Forest lands have burned during that time. 64 percent of the fires and 82 percent of the acres are human caused. This FMU has the lowest rate of lightning-caused fires of the mountain Fire Management Units located on the Pike and San Isabel National Forests.

There was a temporary increase in fire activity associated with the presence of greater numbers of people and their activities during the Settlement Period of the mid 1800's to the early 20th Century. However, increasingly effective fire suppression, combined with the impacts of cultural activities, such as heavy grazing, resulted in decreased fire frequency since the early 1900's (PSICC Fire Management Plan 2013).

Fire history within and adjacent to the project area shows approximately 95 reported fires from the early 1970's to present. Of those 95 fires, approximately 22 percent (21 fires) were reported at larger than 0.1 acre for final size. The largest fire (Treasure Fire) started on June 23, 2012 and burned approximately 420 acres. The location of this fire was approximately 3 miles east of the Tennessee Creek project area.



Treasure Fire June 2012. Photo by A. White.

Urban Interface Issues

There are several private property inholdings located within the Tennessee Creek project area. The closest town to the project area is Leadville, Colorado and it is located approximately 1 mile away from portions of the project area. The Turquoise Lake Recreation Area and Halfmoon Creek drainage include multiple developed campgrounds, picnic areas, and other developed sites. The campgrounds, picnic areas, and surrounding dispersed recreational areas are generally full of recreating public every weekend and many week days throughout the summer and fall. This poses a potential threat for an increased risk of ignitions on National Forest lands due to escaped campfires.

As part of the NWHF project, the Forest Service has done mechanical fuels reduction treatments and pile burning within and adjacent to portions of the Tennessee Creek project area.

Fire Regimes and Condition Classes

Fire has played a historical role in defining the vegetative landscape in and around the project area. Fire is a natural disturbance that has occurred over time in all vegetation types. Fire frequency, size, and intensity historically have varied by fuel type, fuel loading, and elevation within the Rocky Mountains and surrounding areas. A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention but including the possible influence of aboriginal fire use. Below are the typical Fire Regimes for the project area.

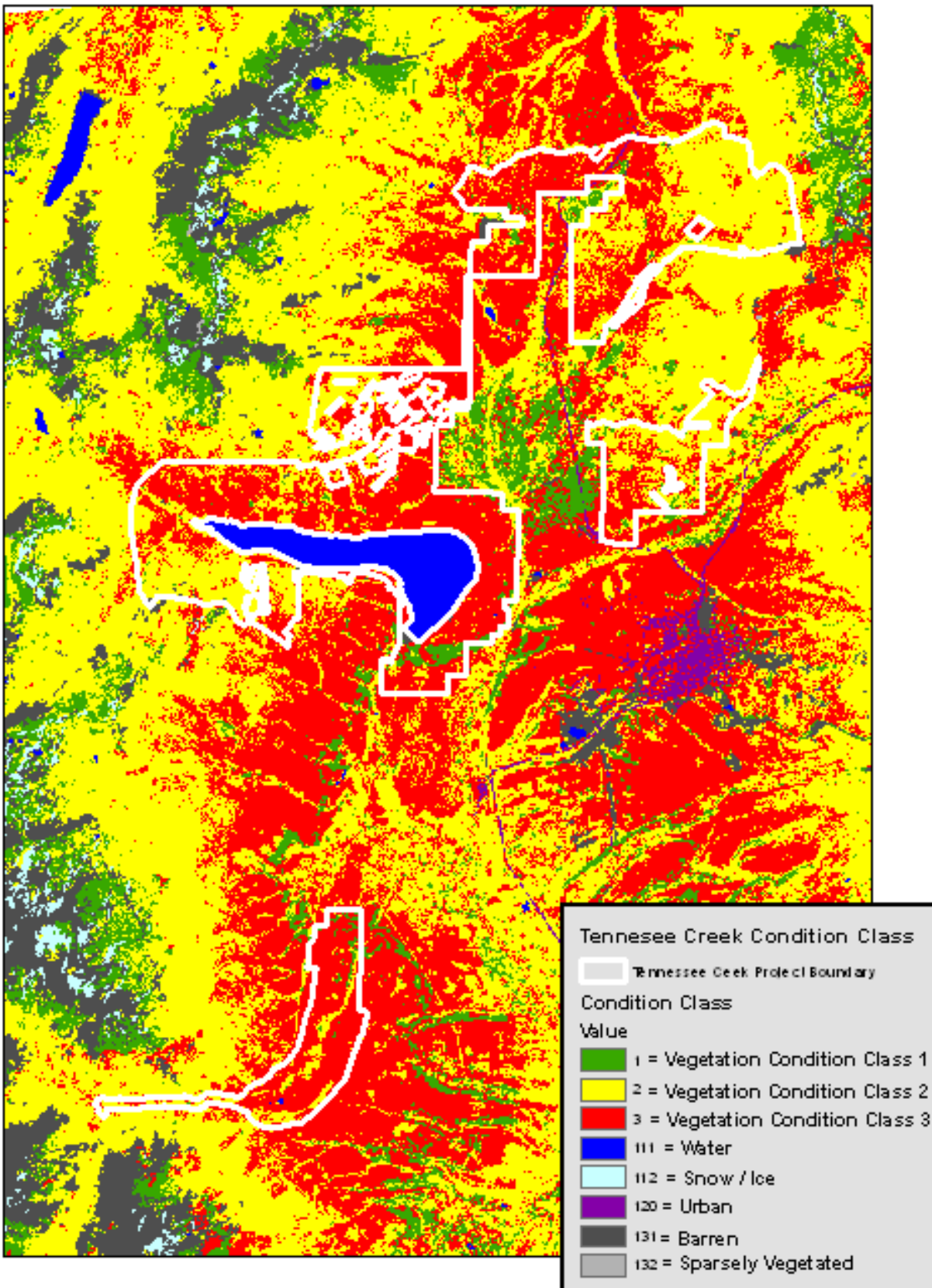
Table 3.7 Typical Fire Regimes for Vegetation Types found within the Project Area

Vegetation	Fire Regime	Frequency and Severity
Grass / Shrub Aspen	I	High frequency (0-35 years) and low to mixed severity
Grass / Shrub Aspen	II	High frequency (0-35 years) and replacement severity.
Lodgepole pine	III	Low frequency (35-200 years) and low to mixed severity
Lodgepole pine Spruce / Fir	IV	Low frequency (35-200 years) and replacement severity
Spruce / Fir	V	Very low frequency (200 + years) and any severity

A Fire Regime Condition Class (FRCC) is a classification (and process of measurement) of the departure from the natural, historical fire regime. Fire regimes for the vegetation within the project area have been altered somewhat due to past and current fire suppression, grazing, and logging activities. As a consequence of these activities, there has been a change in species composition and structure, especially in the short-interval, fire-adapted ecosystems. These changes have led to wildland fire and forest ecosystem health problems. The overall effect has been denser, homogenous stands that may be more susceptible to mixed and high severity wildfires. There are three categories of condition classes: Condition Class 1, 2, and 3; the definition of each Condition Class is available in the Fire and Fuels Specialist Report for the Tennessee Creek Project.

Figure 3.1 shows the condition classes within and adjacent to the Tennessee Creek project area. Condition Classes may have resulted from fire frequencies that have departed from the natural occurrence by at least one return interval, which would alter them moderately to high from their natural, historical range. This alteration could result in: changes to fire size, intensity and severity, and loss of mosaic landscape fire patterns. More evidence that these stands are reaching Condition Class 2 or 3 is by visually observing these forested stands. Changes include: increases in tree density, increases in dead and downed fuels (e.g., down logs and branches), increases in litter in the understory, and encroachment of conifer trees into the mountain grasslands and sagebrush communities.

Figure 3.1 Vegetation Condition Class Within and Adjacent to the Project Area



Surface Fire Hazard and Surface Fuel Loadings

Fire behavior is influenced by topography (e.g., terrain), weather conditions, and fuels (type and characteristics). Of these, only fuels can be altered through vegetation management. Fire behavior fuel models are used to describe vegetation types that produce measurable fire behavior characteristics (Scott and Burgan 2005). These fuel models give an indication of expected fire behavior of a wildland fire under various fuels, weather, and topographic conditions. Table 3.8 describes the three primary fuel models that exist within the project area. Variations in actual fuel conditions in each individual fuel model do exist on the ground.

Table 3.8 Primary Fire Behavior Fuel Models within the Project Area

Fuel Model	% of Project Area	Vegetation Type Description	Fire Behavior	Fuel Characteristics
TL1, TL3	70	Lodgepole Pine: litter/understory	Spread rate and flame length very low	5-6 tons / ac.
GS2	14	Meadows / Sagebrush	Spread rate high; flame length moderate	1 ton / ac.
TL5	11	Spruce-Fir	Spread rate low; flame length low	8 tons / ac.

Canopy Fuel Characteristics and Crown Fire Hazard

Crown fires present special problems. Problems include: crown fires are more difficult to control than surface fires, their rate of spread is several times faster than surface fires, spotting is frequent and can occur over long distances, larger flames from crown fires dictate larger firefighter safety zones, spotting and increased radiation make structures more difficult to defend from crown fires than a surface fire, near total tree mortality should be expected, and smoke production will be greater and foliar nutrients may be lost from the site (Scott and Reinhardt 2001).

There are three main characteristics of canopy fuels: canopy bulk density, canopy base height, and foliar moisture content. Of those, only canopy bulk density and canopy base height can be altered through vegetation management. Canopy Bulk Density (CBD) is defined as the mass of available canopy fuels per unit of canopy volume. It is a bulk property of a stand of trees, not individual trees. Canopy Base Height (CBH) is defined as the lowest height above the ground at which there is sufficient canopy fuel to propagate fire vertically through the canopy. Assessing crown fire potential requires the most accurate estimates of canopy fuel characteristics possible.

There are two indices of crown fire hazard. The Torching Index (TI) is the 20-foot wind speed at which crown fire is expected to initiate. Torching Index is a function of surface fuels characteristics, surface fuel moisture content, foliar moisture content, canopy base height, slope steepness, and wind reduction by the canopy. The Crowning Index (CI) is the 20-foot wind speed at which active crowning is possible. Crowning Index is a function of canopy bulk density, slope steepness, and surface fuel moisture content.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

The No Action Alternative would not change current conditions nor meet the purpose and need of the proposed project. Activities associated with the No Action Alternative are unlikely to be able to restore the project area to a healthier, more typical historical state. On the ground conditions would remain and not change for the short term. In the event of a wildfire, fire behavior would vary across the differing fuel types and fuel loading that exists throughout the project area.

Over time, conditions would change and fuel loadings would increase, resulting in an increased risk of high intensity wildland fire. This would make it more difficult to control a wildfire and increase the risk to firefighter and public safety. Without any large-scale proposed mechanical and/or prescribed fire treatments, the lodgepole pine stands would become more susceptible to mountain pine beetle infestations and allow for a continuous landscape-scale, homogeneous stand which is more susceptible to the negative impacts that wildfires could have on the watershed. Encroachment of conifers would continue into the natural openings, mountain grasslands, and sagebrush communities. This change in natural conditions will reduce the potential that these areas may be used as a natural fuel break, wildland fire control features, and/or safety zones for firefighters.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 1 (PROPOSED ACTION)

The treatments proposed under Alternative 1 are intended to result in a positive or effective change in fire behavior characteristics by reducing or altering the surface and canopy fuel loading. The treatments should achieve a combination of reduced flammability, reduced fire intensity, and reduced potential for torching and/or crown fires. This would increase public and firefighter safety and effectiveness to control wildland fires.

In areas proposed for thinning, flame lengths would be slightly increased in severe fire conditions due to a thinner stand allowing more wind exposure and remain similar to an untreated stand in moderate fire conditions (BEHAVE Runs, Fire and Fuels Specialist Report for the Tennessee Creek Project). Canopy Bulk Density would decrease by approximately half over the next 50 years. This would decrease the potential crown fire behavior due to the lower mass of available canopy fuels within the stand. Canopy Basal Height, Torching Index, and Crowning Index would increase after treatment. With a higher canopy height, it would take a higher wind speed to initiate torching and crowning. The potential fire type would change to surface fires after treatments. In areas proposed for openings, flame lengths would decrease after prescribed fire treatments are completed. Canopy Bulk Density, Canopy Basal Height, Torching Index, and Crowning Index would all drop to 0 and be a non-factor for the next 50 years. The potential fire type would change to surface fires after treatments.

Removal of dead and dying trees throughout the planned treatment areas would reduce the fuel accumulation that would occur through natural deterioration of the standing timber component, especially as ongoing beetle infestations impact the mature stands and move the stands closer to a higher downed fuel loading fuel model. Reduction of encroaching conifers into the natural openings, mountain grassland meadows, and sagebrush communities would maintain these areas and offer them as a potential natural fuel break and/or safety zones for firefighters.

The proposed action also includes prescribed fire treatments. The smoke generated by prescribed burning is considered to be an indirect effect. Smoke emissions can and would be mitigated. Prescribed fire treatments would only be implemented on days with appropriate smoke dispersal forecasts and after a smoke permit is approved by the State of Colorado Department of Environmental Health. The smoke permit would require appropriate meteorological and other specified conditions to reduce or eliminate smoke impacts to identified smoke receptors. Other non-burning options for slash disposal include chipping and/or hauling slash off site.

Different fuel treatments would be evaluated as to how they affect potential torching and crowning. There are differences in the short-term (immediate) and long-term effects (varies over years depending on rates of new vegetation growth and decomposition of dead vegetation) of individual or a combination of surface and canopy treatments. Some treatments may initially have a positive change to fire behavior characteristics (surface or canopy), but over time, may actually result in a negative change. Table 3.9 compares different fuel treatments and their immediate-term effects on the factors that affect Torching Index and Crowning Index.

Table 3.9 Immediate-Term Effects of Fuel Treatments on Factors that Affect the Torching and Crowning Indices

Fuel Treatment	Surface Fuel Load	Dead Fuel Moisture	Canopy Base Ht	Wind Reduction Factor	Canopy Bulk Density
Overstory Thinning	I	D	I or NE	I	D
Understory Removal	I	NE	I	NE	D or NE
Pruning	I	NE	I	NE	NE
Pile Burning	D	NE	NE	NE	NE
Whole-tree Yarding	D	NE	NE	NE	NE
Broadcast Burning	D	NE	I or NE	NE	NE

I = Increase, D = Decrease, NE = No Effect

Another indirect effect would be the increase in surface fuel loading during and immediately after mechanical treatments occurs. This is expected to be a short-term effect lasting until slash and other downed material is removed, piled and burned, and/or broadcast burning occurs. Grass and shrubs may add to the surface fuel loading after vegetative treatments and would continue over time. As new conifer seedlings and saplings grow, this would pose additional surface and ladder fuels that would change the conditions of fuels and altering the potential fire behavior characteristics. Additional mechanical and prescribed fire treatments may be needed in the future to help maintain desired conditions.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 2

The treatments proposed under Alternatives 2 are intended to result in a positive or effective change in fire behavior characteristics by reducing or altering the surface and canopy fuel loading. The treatments should achieve a combination of reduced flammability, reduced fire intensity, and reduced potential for torching and or crown fires. This would increase public and firefighter safety and effectiveness to control wildland fires.

In areas proposed for thinning, flame lengths would be slightly increased in severe fire conditions due to a thinner stand allowing more wind exposure and remain similar to an untreated stand in moderate fire conditions (BEHAVE Runs, Fire and Fuels Specialist Report for the Tennessee Creek Project). Canopy Bulk Density would decrease by approximately half over the next 50 years. This

decreases potential crown fire behavior due to the lower mass of available canopy fuels within the stand. Canopy Basal Height, Torching Index, and Crowning Index would increase after treatment. With a higher canopy height, it would take a higher wind speed to initiate torching and crowning. The potential fire type would change to surface fires after treatments. In areas proposed for openings, flame lengths would decrease after prescribed fire treatments are completed. Canopy Bulk Density, Canopy Basal Height, Torching Index, and Crowning Index would all drop to 0 and be a non-factor for the majority of the next 50 years. The potential fire type would change to surface fires after treatments.

The same effects identified in Alternative 1 are expected to occur with Alternative 2. The main difference would be in the proposed levels or intensity of mechanical treatments and amount of prescribed burning.

Another indirect effect would be the increase in surface fuel loading during and immediately after mechanical treatments occurs. This is expected to be a short term effect lasting until slash and other downed material is removed, piled and burned, and/or broadcast burning occurs. Grass and shrubs may add to the surface fuel loading after vegetative treatments and would continue over time. As new conifer seedlings and saplings grow, this would pose additional surface and ladder fuels that would change the conditions of fuels and altering the potential fire behavior characteristics. Additional mechanical and prescribed fire treatments may be needed in the future to help maintain desired conditions.

CUMULATIVE EFFECTS

The cumulative effects boundary for wildland fire is the general watershed where the project area is located and adjacent area. The cumulative effects of the No Action Alternative would have an adverse effect on general forest health with an increased risk of severe or catastrophic wildland fires over time (wildfires considered as a baseline).

Current projects within the cumulative effects boundary include the Twin Lakes Prescribed Fire Project, Box Creek Vegetation Management Project, and the Northwest Leadville Hazardous Fuel Project. These projects would continue mechanical fuels reduction treatments and/or prescribed fire treatments. The work associated with these projects as well as the treatments proposed under Alternatives 1 and 2 would have large scale benefits to the general landscape as far as reducing fuels and reducing the potential for large catastrophic wildland fires.

Air Quality ---

EXISTING CONDITION

The project area is located at the top of Tennessee Pass and continues south towards Leadville, Colorado with another portion of the project area 6 miles further south. Due to the project location (at a geographic high point at the divide of the Upper Arkansas River Watershed and the Eagle and Blue Watersheds) and the fact that there are not any large cities or densely populated areas located to the east or northeast (the general direction of the transport winds) of the project area, impacts to the air shed would be limited.

Particulate matter (PM) is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. Particles can be suspended in the air for long periods of time. Some particles are large or dark enough to be seen as soot or smoke. Others are so small that they can only be individually detected with an electron microscope.

Particulate matter is classified by size of the particles into two categories, PM10 and PM2.5. PM10, particles less than 10 microns in diameter, pose a health concern because they can be inhaled into and accumulate in the respiratory system. PM2.5, particles less than 2.5 microns in diameter, is referred to as “fine” particles and is believed to pose the greatest health risks. Because of their small size, fine particles can lodge deeply into the lungs. Individuals that may be particularly sensitive to fine particle exposure include people with heart or lung disease, older adults, and children (U.S. Environmental Protection Agency).

Data about pollution is available by County. Table 3.10 shows the PM10 emissions inventory for Lake, Summit, and Park Counties. Particulate Matter is listed because it is of primary concern to the Environmental Protection Agency (EPA) and the proposed treatments are likely to increase particulate matter. However, no data is available for PM2.5 so the PM10 data is shown below as the existing condition. While PM10 from the *Forest and Prescribed Fire* source is only 8 percent of the total PM10 emissions (data from one County only), it is directly related to management activities. The following table is from 2007 and is the most current data from the Colorado Air Pollution Control Division.

Table 3.10 PM10 Emissions Inventory 2007 – County Summary

Source	LAKE COUNTY		SUMMIT COUNTY		PARK COUNTY	
	PM 10 (tons/yr.)	PM 10 (% of total)	PM 10 (tons/yr.)	PM 10 (% of total)	PM 10 (tons/yr.)	PM 10 (% of total)
Agriculture	0	0	0	0	0	0
Aircraft	0.62	0	N/A	0	N/A	0
Biogenic	0	0	0	0	0	0
Commercial Cooking	2.63	0.1	27.64	1.3	7.18	0.3
Construction	147.04	8.2	708.05	35	690.37	29.2
Forest/Prescribed Fire	N/A	0	N/A	0	199.53	8.4
Fuel Combustion	0.07	0	0.17	0	0.12	0
Highway Vehicles	4.33	0.2	33.57	1.6	12.38	0.5
Non-Road	6.9	0.4	25.31	1.2	18.34	0.8
Other Point Sources	1256.96	70.2	47.15	2.3	65.63	2.8
Road Dust	293.39	16.4	953.96	47	1205.87	51
Structure Fires	0.09	0	0.28	0	0.18	0
Wood burning	77.64	4.3	252.9	12.3	171.22	7.2
TOTALS	1790.25	100	2048.22	100	2370.82	100

* Not all Counties have recorded data from all sources.

Attainment / Maintenance Areas

There are no non-attainment areas of National Ambient Air Quality Standards (NAAQS) within or near the Tennessee Creek project area. The two closest Attainment / Maintenance Areas are located

in Aspen (approximately 30 miles to the west) and the Denver Metropolitan Area (approximately 100 miles to the east / northeast). Both of these areas had previously exceeded EPA NAAQS for PM₁₀ putting them into non-attainment classification, but State Implementation Plans have regulated and mitigated past issues. Recognizing that certain uncontrollable natural events (e.g., high winds and wildfires) and management activities (e.g., prescribed fires) can have negative effects on the NAAQS, it is the responsibility of the Colorado Department of Public Health and Environment – Air Pollution Control Division to take into consideration all aspects of prescribed burning.

Smoke Sensitive Areas

There are three identified Colorado Smoke Sensitive Areas located within a 30 mile radius of the project area. The closest is a 5-mile radius buffer in Leadville that overlaps approximately a third of the project area. The others are in Buena Vista and near the Copper Mountain area. Predicted daytime smoke flow would most likely be to the northeast of the project area, which would be to the east of the Cooper Mountain Area. Predicted nighttime smoke flow would be most likely be down drainage which would move towards the Buena Vista area. Smoke sensitive areas, *or receptors* are defined as, “Class I areas and other locations of scenic and/or important vistas, especially during periods of significant public use, urban and rural population centers, schools, hospitals, nursing homes, transportation facilities such as roads and airports, recreational areas, and other locations that may be sensitive to smoke impacts for health, safety, and/or aesthetic reasons” (Colorado Air Quality Control Commission, Regulation #9).

Table 3.11 Smoke Receptors near the Tennessee Creek Project Area

Area	Distance from Project	Direction from Project
Leadville	1 mile (at closest point)	East, South, Northeast
Twin Lakes	5 miles	South
Granite	10 miles	Southeast
Red Cliff	12 miles	North
Copper Mountain	14 miles	Northeast
Fairplay	15 miles	East
Buena Vista	24 miles	Southeast

Wilderness Areas

There are three Class I Federal Areas within approximately 40 miles from the Tennessee Creek project area. The closest is approximately 12 miles to the north. There are several wilderness areas (Class II areas) in close proximity to the project area. While not protected as Class I under the Clean Air Act of 1977, they still require some thought as to potential visibility impacts by management decisions and actions.

Table 3.12 Class I Federal Areas and Wilderness Areas (Class II)

Area Name	Class	Distance from Project	Direction from Project
Eagles Nest Wilderness	I	12 miles	North
Maroon Bells – Snowmass Wilderness	I	22 miles	West
West Elk Wilderness	I	41 miles	Southwest
Mount Massive Wilderness	II	0 miles	West
Holy Cross Wilderness	II	0 miles	Northwest
Hunter - Frying Pan Wilderness	II	5 miles	West
Collegiate Peaks Wilderness	II	6 miles	South
Buffalo Peaks Wilderness	II	8 miles	Southeast
Lost Creek Wilderness	II	32 miles	East

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

Under the No Action Alternative, mechanical fuels reduction and pile burning would continue on a limited basis in portions of the project area. This would take place around developed sites within and around Turquoise Lake, Halfmoon drainage, and within the Northwest Leadville Hazardous Fuels project boundary. As a result, there would be limited direct effects. With the No Action Alternative there is the potential for an increased risk from wildfires to have an effect on air quality within and downwind of the project area. This would continue to increase over time, until vegetation/fuels were manipulated, either by a future management decision or a wildfire(s).

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES

The primary area that would be affected includes the general project area and downwind / down drainage of the project area. The smoke sensitive areas (i.e., receptors) that are most likely to be affected would include Leadville, Fairplay, Granite, and Buena Vista. Direct effects would be from smoke emitted during prescribed fire implementation. This would occur from burning piles in areas that have had natural and activity fuels piled. Pile burning occurs mainly during the winter months when there is snow covering the ground. Duration of pile burning depends on how many total piles and the Colorado Smoke Management Program permit conditions. Piles that are ignited are usually consumed and done producing smoke within 12 – 24 hours.

The other method of smoke emission would be from broadcast burning. Broadcast burning typically occurs in the spring season and/or in the fall season, depending on fuel and environmental conditions. Broadcast burns are usually scheduled for 1 – 3 days and smoke is emitted for 2 – 5 days after ignition is completed. The amount of smoke / emissions is directly related to the fuels burned (type, quantity, and moisture content). It is expected that prescribed fire activities would occur between 2 – 4 years after a vegetation treatment occurs.

Smoke from prescribed fire treatments is regulated and monitored by the Colorado Department of Public Health and Environment – Air Pollution Control Division. The Forest Service is required to consult with the State and apply for smoke permits for all prescribed fire treatments (pile and broadcast), under Colorado Air Quality Control Commission, Regulation #9. The State uses emission modeling programs in the permitting process. The State sets the maximum number of acres or piles to be burned in a day. They also set limits and requirements on wind directions, smoke dispersion,

and ignition start and end times. The Forest Service follows the State issued permit, while also attempting to minimize the likelihood of negative smoke impacts. Some mitigation methods to limit or to help reduce the amount of smoke, the duration of smoke, or the public's exposure to smoke may include:

- Pre-burning media contacts (radio/newspaper)
- Notification / discussion with closest residents
- Monitor fuel moistures and conditions prior to burning
- Prescribed burning activities will only be conducted when smoke dispersal rating is forecasted to be fair or better.
- Receptors will be monitored by burn personnel for smoke impacts and any impacts will be reported to the Burn Boss. Ignition may be modified and/or suspended. Mop-up may be started if impacts appear imminent or are occurring.

Besides the smoke permit, a Prescribed Fire Plan specific to the project area is required for any ignitions. This is prepared by Fire and Fuels Management and approved by the Line Officer. This Prescribed Fire Plan follows direction set forth in Forest Service Manuals, as well as the Interagency Prescribed Fire Planning and Implementation Procedures Guide.

CUMULATIVE EFFECTS

Under the No Action Alternative and Alternatives 1 and 2, air quality would potentially be impacted more so during the summer and early fall months. This is due to the higher probability of large naturally-occurring wildfires throughout the western United States. Wildfires are considered as a baseline and not included as a cumulative effect. Smoke flows with the transport winds from west to east and can affect visibility within and adjacent to the project area.

Prescribed burning would most likely occur in other areas adjacent to the project area, as well as other public lands. Pile burning is scheduled from late fall through spring and broadcast burning usually happens in the fall and spring seasons. Other land managers (public and private) may do prescribed burning that overlaps with the burning within the project area. This is rare and cumulative impacts would be minimal to the project area and surrounding area. The smoke impacts from wildfires and smoke impacts from scheduled prescribed burns are not likely to overlap due to the different times of year that they typically occur.

Recreation and Wilderness

EXISTING CONDITION

According to the 2002 National Visitor Use Monitoring (NVUM) survey completed by the PSICC NF, the top five recreation activities were: viewing natural features, relaxing, viewing wildlife, pleasure driving, and hiking. In addition, "scenery" and "attractiveness of the forest landscape" were the most important attributes to visitor's recreation experience. All of the above activities are actively occurring and are present within the project area.

Substantial developed recreation enhancements occur in the Turquoise Lake Recreation Area and Halfmoon Creek drainage. Amenities include twelve campgrounds, four day use sites, one boat ramp, fishing access sites, three overlooks, and numerous trailheads. Occupancy rates at Turquoise Lake facilities can be very high with full campgrounds on weekends and holidays throughout the summer operating season. Campgrounds and related facilities are operated by a concessionaire. Ski Cooper and the Tennessee Pass Nordic Center and Cookhouse are located at the northern edge of the project area with 26 trails, two main aerial lifts, nine miles of Nordic trails, and approximately 58,000 visitors a year.

Dispersed recreation, including: camping, hiking, cross-country skiing, snowmobiling, sightseeing, fishing, hunting, mountaineering, and OHV uses, occur throughout the project area. Halfmoon Creek experiences heavy use during the summer season due to its ability to offer multiple recreation opportunities which encompasses: overnight camping, four-wheel drive roads, OHV uses, fishing along the creek and Emerald Lake, and access to Mt. Massive and Mt. Elbert (both are 14er peaks).

The Colorado Trail and Continental Divide National Scenic Trail both bisect the project area and are very popular amongst hiking and horseback enthusiasts. Other trails in the project area are the Willow Creek Trail and the Turquoise Lake and Nature Trails.

The Continental Divide National Scenic Trail is expected to be approximately 3,100 miles stretching from the Canada-United States border on the north to the United States-Mexico border on the south. Some portions of the trail are still under construction. Approximately seven miles of the CDNST is located along the north and west portion of the project area (areas include Tennessee Pass, west of Turquoise Lake and western portion of Halfmoon Creek). The project area may be visible from other areas of the CDNST located outside of the project area.

The 2009 CDSNT Comprehensive Plan and Forest Service Manual (FSM2350) describe the nature and purposes of the CDNST as:

“The nature and purposes of the CDNST are to provide for high quality scenic, primitive hiking and horseback riding opportunities and to conserve natural, historic, and cultural resources along the CDNST corridor.” FSM 2353.42

Each CDNST component listed in the statement above was reviewed as it relates to the project and is summarized below in the direct and indirect effects section.

Within all treatment areas motorized travel is restricted to designated routes only; beginning in 2008 a Motor Vehicles Use Map was created for the public. Paved county roads encircle Turquoise Lake and provide scenic access to three overlooks. Halfmoon, Hagerman, and Mt. Zion roads afford four-wheel drive access to high alpine scenic areas. The Top of the Rockies National Scenic Byway traverses through the project area as well.

The following Lake County Roads are located within and/or adjacent to the Tennessee Creek project area: CR 5, CR 99 (near Grand West Estates), CR 9A (near St. Kevin), CR 18 (along East Tennessee Creek), CR19 (near Webster’s Gravel), CR 20 (to Sylvan Lakes subdivision), CR 29 (near Ski Cooper Ski Area), CR 21A, CR 11 (along Halfmoon Creek), and CR 4, 9 and 9C (near Turquoise Lake). Many of these roads provide access to the National Forest.

County Roads 4, 9, 9A, and 9C are not plowed in the winter. The county roads are closed to normal vehicle traffic and are groomed in the winter for winter recreation, including snowmobiling and

cross country skiing. County Road 11 is only plowed to the private homes; it is not plowed west of the private homes.

User-created motorized routes exist within the project area. These non-system routes have been created by the public and have not been approved by the Forest Service for public use. Locations that have a concentration of non-system routes include Halfmoon Creek and areas below the Sugar Loaf Dam. Seasonal road closures exist on FSR 102, 131, and 189.

Numerous permitted Outfitter and Guides operate within the project area. They provide hiking, boating, hunting, fishing, snowmobiling, mountaineering, snowcat skiing, horseback riding, and overnight camping opportunities. Several permitted recreation events provide competitive fishing, OHV tours, bike races, and foot races, including the Leadville 100.

The Holy Cross and Mt. Massive Wildernesses are located adjacent to the project area with a total of 27,000 acres on the Leadville District.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

Recreation uses and wilderness visitations would continue within, and adjacent to, the project area as currently administered. However, in the long term the potential for beetle outbreaks and wildfire impacts on recreation users and wilderness experience would potentially increase. These impacts include the visual landscape being altered, damage or loss of recreation infrastructures, and temporary closing affected areas of the district to the public.

DIRECT AND INDIRECT EFFECTS COMMON ON BOTH ACTION ALTERNATIVES

Conventional ground-based logging activities would be both visible and audible to all types of recreation and wilderness visitors from within, and adjacent to, the project area. Logging traffic would be encountered within the project area and on haul routes. This would result in a short-term reduction in the quality of the visitors' experience. Some visitors may choose to seek other locations on the district without harvesting activities.

Permitted recreation activities including outfitters and guides, non-commercial group uses, and recreation events that occur directly in conflict with logging operations would be temporary relocated to other suitable locations.

Newly-created temporarily roads would be visible to the public but would not be open to public motorized uses. This would be accomplished through the use of signs, gates, or other closures methods. In addition the Motor Vehicle Use Map restricts motorized usage to designated routes that are open to public travel.

Snow plowing on Forest System roads would temporarily displace snowmobile and cross-country skiers to other roads that are not plowed.

Restoring non-system routes and dispersed sites located in riparian areas would enhance the future recreation visitor's experience. Rehabilitated camp sites located at Turquoise Lake and Halfmoon Creek would enhance the visitor's experience at those locations. Visual landscapes would be slightly

or moderately altered from their current condition depending on the associated Management Area Prescriptions and intensity of logging operations. These altered landscapes would be visible from system roads, general forest areas, developed sites, system trails, and from within the Wildernesses. Sections of roads and trails that are within treated areas and utilized during winter months by cross country skiers and snowmobiles would become day lighted. This would result in increased snow melting and their subsequent intermittent usability and a shortened season of use. Maintaining vegetation cover within the ski area would allow skiers to experience a winter recreation opportunity that is currently available.

In addition to the effects of conventional ground-based logging operations listed above, smoke from on-going prescribed fire activities would be visible and smelt by recreation and wilderness visitors. Visitors would be prohibited from the burn areas during and immediately following prescribed fires. In addition, permitted activities including outfitters and guides, non-commercial group uses, and recreation events would be temporarily relocated to suitable locations.

Reducing the possibility of wildfires would potentially result in less displacement of recreation visitors and authorized activities. Existing infrastructures such as campgrounds, trails, and ski areas would be better protected against damaging wildfire. Reducing the possibility of beetle outbreaks would potentially result in less displacement of recreation visitors and authorized activities. Also, visual landscapes would be less altered from the effects of uncontrolled wildfire and insect and disease outbreaks.

Effects to the Continental Divide National Scenic Trail

In general, the effects to the CDNST were based on the likelihood of treatments being seen from the trail and took into account forest density and openings along the trail. The integrity of the CDNST was taken into consideration in the design of the treatments and is therefore not expected to be substantially impacted. Additional information for each section can be found in the specific section for recreation, heritage, soil and water, botany, fisheries, and wildlife.

Scenic Resources

According to the 2009 CDNST Comprehensive Plan - scenery management has dual purposes, to manage the quality of the visual environment and to reduce the visual impacts of development activities while maintaining effectiveness in all agency resource programs. Specific design criteria have been established to minimize visual impacts along the CDNST for this project. These include restrictions on the use of tree marking paint, resulting stump heights, placement of slash piles, feathering of thinning treatment units 150 feet from the trail, and limiting the size of openings that would be created. Refer to the Design Criteria in Chapter 2 for the specific measures that will be put in place.

In addition, the CDNST falls in the PSICC Forest Plan Management Area 2B with a Visual Quality Objective (VQO) of Partial Retention. Treatments that occur in areas as seen from the CDNST will have a Visual Quality Monitor on site when laying out treatment areas. This will ensure that planned activities are compliant with the provisions of Partial Retention. Under Partial Retention activities may repeat the form and line common to the characteristic landscape. Treatment activities may also introduce form and line characteristics not found in the landscape. However, changes in the qualities of size, amount, intensity, direction, and pattern shall remain visually subordinate. Duration of visual impacts: Reduction in form, line, color, and texture should be accomplished as soon as

possible or at a minimum within the first year. Therefore, prescribed fire, timber treatments, and watershed improvements are allowed within the VQO of Partial Retention.

Primitive Hiking and Horseback Riding

Conventional ground-based logging activities would be both visible and audible to CDNST visitors from within, and adjacent to, the project area. Logging traffic would be encountered within the project area and on haul routes. CDNST users would encounter small openings created from treatment activities. Some visitors may choose to seek other locations on the district to recreate. This would result in a short-term reduction in the quality of the CDNST users' experience. Long-term impacts along the CDNST from treatments would be beneficial resulting in less dense tree stands that would be less susceptible to beetle activity, while remaining within visual standards provided in the forest plan. Smoke from on-going prescribed fire activities would be visible by CDNST visitors. These visitors would be prohibited from the burn areas during and immediately following prescribed fires. It is expected that effects from prescribed burning would be visible for one to three years.

Natural Resources

Impacts to sensitive or federally listed plant species along the CDNST were analyzed as part of the Botany section. Determinations for sensitive plant species were not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing or a loss of species viability range-wide. In addition, there are no known occurrences of federally listed threatened, endangered, or proposed plant species in the proposed project area. There is also no known habitat, including proposed or designated critical habitat, for any of these species in the proposed project area (see Final EA, Chapter 3, Botany section).

Impacts to the CDNST in regards to watersheds, aquatic habitats, and wildlife habitats were analyzed as part of the Hydrology/Soils, Fisheries, and Wildlife sections. The proposed actions would improve watershed health and reduce the potential impacts of catastrophic fire over the long-term. Minor short-term impacts from implementation, mainly ground disturbance resulting in erosion and sedimentation, would occur. However, best management practices would reduce the duration and intensity of those impacts. Long-term positive benefits to the aquatic environment would be provided by protection from catastrophic wildfire. In addition to vegetative treatments and prescribed burning, the proposed action also includes implementation of projects designed to improve aquatic and riparian habitats. Upon implementation, all of these actions would provide long-term positive impacts for aquatic habitat, resulting in a higher abundance and improved fishing.

Determinations for sensitive wildlife species were not likely to result in a loss of viability. Threatened and Endangered species analysis of treatments resulted in "may effect, not likely to adversely effect" determination and is not likely to adversely affect habitats (see Final EA, Chapter 3, Wildlife section).

Cultural and Historical Resources

Impacts to heritage resources along the CDNST were analyzed as part of the Cultural Resources section. To date, 55 historic properties (termed "prehistoric sites" or "historic sites") have been identified and recorded throughout the project area. These sites would be avoided in order to prevent potential adverse effects to cultural resources or a site specific mitigation plan would be

developed to minimize the adverse effects. If eligible sites are discovered during subsequent surveys or during project implementation, these sites would also be avoided by project activities.

Broadcast burning poses relatively little threat to cultural resources, except for wooden architectural sites such as log cabins or corrals, and in areas where the intensity of the burn is such that it denudes all surface vegetation and topsoil. Construction of ground disturbing control lines also has the potential to disturb subsurface cultural deposits.

The reduction of fuels in the project area would have indirect effects on historic properties in the project vicinity by reducing the probability that an uncontrolled wildfire would modify or destroy these sites. Watershed improvement projects would have indirect effects on historic properties in the project area by reducing soil erosion and improving watershed conditions thereby protecting cultural deposits that otherwise could result in artifact displacement and deterioration of delicate organic materials.

CUMULATIVE EFFECTS

The project area includes the Turquoise Lake Recreation Area and three general forest areas: Halfmoon Creek, east and west of Tennessee Pass, and Mt. Zion. Therefore, the geographic area considered for cumulative effects includes all lands north of Halfmoon Creek to Tennessee Pass. The time period under consideration is from past activities to ten years in the future as this will include all known and reasonably foreseeable actions.

Limited vegetation management (e.g., thinning, group selection, and patch cuts) has been, and is currently, occurring around the Turquoise Lake Recreation Area and Halfmoon Creek drainage. The effects of this project would be to accelerate these treatments, particularly in lodgepole pine stands. Hazard tree removal at developed sites, along roads and trails would continue in the future as staffing permits and as needed.

Non-system routes exist in numerous locations within the project area particularly south of Sugar Loaf Dam and the Halfmoon Creek drainage. Restoration of these routes occurs on a case-by-case basis as funding allows. Treatments in areas navigable by OHVs and snowmobiles may result in an increase in motorized access. These motorized intrusions would result in displacing recreational users seeking a non-motorized experience. However, through the use of project design criteria and law enforcement efforts it is not anticipated that new non-system routes would be created within the project area. In addition, the Motor Vehicle Use Map and its associated prohibition (36 CFR 261.13) restrict motor vehicles (snowmobiles excluded) to designated roads that are open to public travel. This prohibition will continue into the foreseeable future.

Ongoing development of private inholdings and private lands adjacent to the forest boundary are taking place primarily for residential purposes thereby increasing recreational uses on National Forest System lands and wilderness within the geographic area. Numerous ongoing recreation events take place in Lake County on highways and lands adjacent to the geographic area. These events are likely to continue and grow in size in the foreseeable future. In addition, recreation tourism in Lake County will continue to occur throughout the geographic area. The effects of this project on these activities include members of the public encountering logging traffic, seeing and hearing logging operations, and the visual landscape being moderately altered. Smoke from prescribed fire operations would also be seen by the public and event participants.

Lands Uses (Non-Recreation) and Minerals

EXISTING CONDITION

Authorizations for lands uses include: road access to private inholdings, power transmission lines, dam, a ditch, and a communication site. In addition, numerous private land inholdings exist throughout the project area.

Aerial power transmission lines are located to the north and southwest of Turquoise Lake. The Bureau of Reclamation operates the Sugar Loaf Dam, two diversion tunnels, and subsequently the Turquoise Lake water level. Pueblo Water operates the Burton Ditch located to the southwest of the Ski Cooper Ski Area. Wurts Ditch is located in the far northwest area of the project. One communication site is located near Mt. Zion and is authorized under a Lease Agreement with CenturyLink at this time.

Various levels of Forest System Roads within the project area can accommodate passenger vehicles, high clearance vehicles, and OHVs. Paved and gravel county roads (4, 9, 9C, 21A, 29, 19) are authorized through a Public Road Easement.

There is currently no known active Plan of Operations for Mining within the project area. However, evidence of past mining operations and Abandoned Mine Lands (AML) can be found throughout the project area. Small, non-mechanical mining operations can be found on a case-by-case basis, through a Notice of Intent, in the project area.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

Authorized lands uses and mining operations would continue within, and adjacent to, the project area as currently administered. However, the potential for beetle outbreaks and wildfire impacts on land uses and mining operations would potentially increase. These impacts include temporary loss of access and damage or loss of infrastructure.

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES

Owners of permitted uses, inholding, and mining operations would encounter short term logging traffic on Forest system roads. Conventional ground-based logging activities would be both visible and audible from within, and adjacent to, the project area. Logging activities could temporarily offset some operations, such as maintenance of power lines and mining. The Wurts Ditch would become easier to maintain than if the surrounding areas were left untreated.

Temporary loss of access in locations where the public are prohibited from entering would occur within prescribed fire operations. Reducing the possibility of wildfires would potentially result in existing infrastructure being better protected against damaging wildfire. Mining operations would be less affected and displaced by wildfire events.

CUMULATIVE EFFECTS

Abandoned mine restoration is occurring on private lands immediately adjacent to the southwest of Turquoise Lake. Restoration efforts would be better protected from damaging wildfires and insect and disease outbreaks.

Webster's Gravel operates a gravel pit immediately adjacent to the forest boundary near West Tennessee Creek. The effects of this project would be to better protect the operations of this gravel pit from damaging wildfire events that originate on adjacent National Forests lands.

Wildlife

EXISTING CONDITION

FEDERALLY LISTED THREATENED, ENDANGERED AND CANDIDATE WILDLIFE SPECIES

Threatened, endangered and candidate species with the potential to occur within the analysis area on the San Isabel National Forest as well as on the White River National Forest are listed below in Table 3.13. For more species information, please refer to *Threatened, Endangered, and Forest Service Sensitive Species on the Pike and San Isabel National Forest* (Wrigley 2012).

For this analysis, the analysis area is defined as within ½ mile of the proposed management boundary for all species except for the Canada lynx (*Lynx canadensis*) and North American wolverine (*Gulo gulo luscus*). Canada lynx will be analyzed at the Lynx Analysis Unit (LAU) scale (Tennessee Pass and Massive LAUs) which have been identified for this species by the Forest Service and wolverine will be analyzed at the district scale.

Table 3.13 Threatened, Endangered, and Candidate Species with Potential to Occur Within the Analysis Area

SPECIES COMMON AND SCIENTIFIC NAME	STATUS ¹	COUNTY	POTENTIAL TO OCCUR?	RATIONALE FOR EXCLUSION ²	BRIEF HABITAT DESCRIPTION AND RANGE IN COLORADO
INVERTEBRATES					
Uncompahgre fritillary butterfly <i>Boloria acrocynema</i>	E	Lake Eagle		HAB	Known to only occur above timberline on Mt. Uncompahgre, laying eggs on snow willow (<i>Salix nivalis</i>); potentially occurring in Custer and Saguache Counties.
BIRDS					
Greater sage-grouse (<i>Centrocercus urophasianus</i>)	C	Eagle		ODR	Sagebrush obligate with grass/forb understory in rolling or mountainous terrain, with water nearby in spring 4,500 to 9,000 ft. elevation.
Mexican Spotted owl (<i>Stix occidentalis lucida</i>)	T	Eagle		HAB	Steep-sided rocky canyons or outcroppings with old-growth mixed conifer (ponderosa pine, Douglas-fir, white fir) forests possessing cool, shady microclimates; up to 9,500 ft. elevation. Critical habitat is designated by FWS.
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	C	Eagle		ODR	Eastern subspecies; riparian forests along the Arkansas River and urban areas with tall trees; a rare to uncommon spring and fall migrant and summer resident of E Colorado and SW KS and potentially on the San Carlos RD.
MAMMALS					
Canada lynx <i>Lynx canadensis</i>	T	Lake Eagle	X		Dense spruce-fir, Douglas-fir, early seral lodgepole pine, mature lodgepole pine with developing understory of spruce-fir and aspen in subalpine zone and timberline, using caves, rock crevices, banks, logs for denning, closely associated with snowshoe hare.
Gunnison's prairie dog <i>Cynomys gunnisoni</i>	C	Lake		ODR	Shrub-grassland habitats between 6,000-12,000 ft. in mesic plateaus, intermountain valleys, benches and arid lowlands
North American Wolverine <i>Gulo gulo luscus</i>	C, S	Lake Eagle	X		Alpine & subalpine mature/intermediate timbered areas around natural openings, including cliffs, slides, basins, & meadows, dependent on ungulates, historically in CO, extending the length of the Rocky Mts.

¹Status Codes: E=Federally listed endangered; T=Federally listed threatened; C= Federally candidate/proposed for listing

²Exclusion Rationale Codes: ODR=outside known distributional range of the species; HAB= no habitat present in Analysis Area; ELE= outside of elevational range of species

Only those federally threatened, endangered and proposed/candidate species with the potential to occur (i.e., habitat is present) within the analysis area or be affected by the proposed alternatives are addressed hereafter in this assessment (evaluated species). Species shown in the table above as excluded will not be analyzed further based on the rationale provided here and in Wrigley et al. (2012). The proposed alternatives will have no effect/impact to those species.

Canada lynx

The Tennessee Creek project area is located within the Tennessee Pass and Massive LAUs. On National Forest System lands within the Pike and San Isabel Forest, there are approximately 897,306 acres of mapped lynx habitat with 19,953 acres of lynx habitat falling inside Tennessee Pass LAU and 22,114 acres falling inside the Massive LAU. Within the project area there are approximately 9,480 acres of mapped lynx habitat.

“In the southern portion of its range (within which this project lies), lynx populations appear to be limited by the availability of snowshoe hare (*Lepus americanus*) prey, as suggested by large home range sizes, high kitten mortality due to starvation, and greater reliance on alternate prey, especially red squirrels (*Tamiasciurus hudsonicus*), as compared with populations in northern Canada” (Ruediger 2000).

The highest quality snowshoe hare habitats are those that support regenerating trees or shrubs that are available above the snow during the winter. Stands that provide 35 percent or greater dense horizontal cover fall into this category. This condition can be present in regenerating stands as well as an understory layer in mature stands. Red squirrel densities tend to be highest in mature cone-bearing forests with substantial quantities of coarse woody debris (Ruediger 2000).

The project area contains extensive amounts of lynx habitat (seral lodgepole, spruce-fir, and aspen) that are known to support snowshoe hare populations (field observations J. Windorski 2011-2013). The area also supports alternate lynx prey species such as red squirrel.

Lynx are currently found inside the project area. This was evident during a research project conducted in February and March of 2013. Three lynx were trapped and released inside the Massive LAU within spruce-fir and lodgepole forests near designated wilderness areas. Tracks were also observed outside of the research area in southern portions of the Massive LAU. Game cameras and observations by recreationists (confirmed with photos) revealed that up to three lynx were spending time in the Tennessee Pass LAU in the winter of 2011-12. The current habitat in the project area is supporting at least three lynx but population estimates for the LAUs are not available.

Linkage Areas

Most of the Tennessee Creek Project boundary is entirely within the much larger Tennessee Pass Linkage Area and any potential impacts to it will be addressed. Refer to the *Tennessee Creek Biological Assessment* for a complete discussion of linkage areas. The Halfmoon Creek portion of the Tennessee Creek Project is not within any linkage area. The Tennessee Pass Linkage Area is made up a portion of the Tennessee Pass LAU as well as most of the Massive LAU from the San Isabel National Forest. There are portions of the Camp Hale and Holy Cross LAUs from the White River National Forest included in the northern end of the linkage area. There is no part of the linkage area that is outside of an LAU.

North American Wolverine

In North America, wolverines occur within a wide variety of alpine, boreal, and arctic habitats, including boreal forests, tundra, and western mountains throughout Alaska and Canada. The species range extends to high elevations of Colorado. Wolverines do not appear to specialize on specific vegetation or geological habitat aspects, but instead select areas that are cold and receive enough

winter precipitation to reliably maintain deep persistent snow late into the warm season (Copeland 2010). Persistent, stable snow greater than 1.5 meters (5 feet) deep appears to be a requirement for natal denning, because it provides security for offspring and buffers cold winter temperatures (U. S. Fish and Wildlife Service 2013). Information on wolverine abundance is not available. Therefore estimating population trends cannot be done at this time though it is believed that populations in the Southern Rocky Mountains are extremely low and are not sustainable at current levels (U. S. Fish and Wildlife Service 2013). These deep snow habitats persisting into the spring are found on the Leadville Ranger District and at the extreme upper elevation limits of the Tennessee Creek project boundary.

FOREST SERVICE SENSITIVE SPECIES

A complete list of Forest Service sensitive with the potential to occur within the analysis area on the San Isabel and/or the White River National Forest is available in the Wildlife Biological Evaluation and Management Indicator Species Report. For more species information, please refer to *Threatened, Endangered, and Forest Service Sensitive Species on the Pike and San Isabel National Forest* (Wrigley 2012). Only those Forest Service sensitive species with the potential to occur (i.e., habitat is present) within the analysis area or be affected by the proposed alternatives will be addressed.

Riparian Habitat Species – Boreal Toad, Northern Leopard Frog, and River Otter

The sensitive species analyzed in this section are grouped together because they are all regularly dependent on riparian habitats (e.g., stream banks, shorelines, ponds, lakes, or wetlands) and actions that affect these habitats may impact these species.

Boreal toads (*Anaxyrus boreas boreas*) and northern leopard frogs (*Lithobates pipiens*) inhabit slow moving or stagnant waters often found in or near historic or active beaver ponds, lakes or ponds with emergent vegetation as well as upland areas. The primary threat to toads and frogs is believed to be habitat alteration and degradation, water quality, diseases, and introduction of predators to breeding areas (Smith 2007). There are breeding toads on the district though none were found during extensive amphibian surveys (2011, 2012, and 2013) in suitable habitat within the project area. There have been no records of northern leopard frogs on the Leadville Ranger District, but there have been on the Eagle-Holy Cross Ranger District and there is suitable habitat inside the project area.

River otters (*Lontra canadensis*) are typically associated with streams, lakes, and reservoirs with high water quality and good food sources (fish or crustaceans). The other important habitat attribute is riparian vegetation, which provides security cover when they are feeding, denning, or moving on land (Boyle 2006). There has been one recent confirmed sighting in 2011 on the Leadville Ranger District but not within the project area and another unconfirmed sighting in 2013 within the project area.

Sagebrush Species – Brewer's Sparrow

Brewer's sparrows (*Spizella breweri*) are present within the project area where sagebrush communities are found. Sagebrush habitats within the project area, as well as the District, are typically small in size and occur as a mosaic within forested and other mountain grass and shrubland habitats.

Aspen and Douglas-fir habitats – Flammulated Owl

Flammulated owls (*Otus flammeolus*) are typically found in older stands of dry coniferous forests, especially ponderosa pine. Douglas-fir and aspen stands can also provide suitable habitat for these small owls. The aspen (approximately 455 acres) and minute amount of Douglas-fir (24 acres) inside the project area could provide some flammulated owl habitat. The aspen and aspen/conifer areas provide for the best flammulated owl habitat in the project area. There are no documented occurrences on the district but there have been only limited surveys for flammulated owls on the district and none specifically for the Tennessee Creek project area. Because this species shows a close association with older forests, declines in the extent of mature and older forests due to timber harvest and fires may have led to declines in the species (Wrigley 2012).

Lodgepole Pine Habitat Species – Northern Goshawk, Bald Eagle, Hoary Bat, and Rocky Mountain Bighorn Sheep

On the Leadville Ranger District, four species are grouped together because the habitat they utilize most frequently is lodgepole pine. For example, bighorn sheep (*Ovis canadensis Canadensis*) are usually found in open, rocky, steep terrain but they can be found in lodgepole pine when accessing mineral sources or traveling even if lodgepole pine is not a main habitat requirement. Of the eleven known northern goshawk (*Accipiter gentilis*) nests inside the project area, seven of them are located in lodgepole pine trees (the other four in aspen trees). However, aspen stands are important for goshawks as well and are usually found somewhat adjacent to the lodgepole pine nests. Bald eagles (*Haliaeetus leucocephalus*) are highly associated with and build nests adjacent to lakes and reservoirs that provide quality foraging habitat. The habitat directly surrounding and along the shoreline of Turquoise Lake, where bald eagles would likely nest if in the project area, is dominated by lodgepole pine. There are no known bald eagle nests inside the project area. Hoary bats (*Lasiurus cinereus*) are generalists when it comes to habitat, utilizing any forested stands throughout their range. There are no known records of hoary bats on the district or inside the Tennessee Creek project area though they are assumed to be present in low numbers on the district. Key elements of suitable bighorn habitat include steep, broken terrain, which serves as escape cover, and vegetation types that provide high visibility and forage such as grasslands and alpine tundra. Most of their time is spent in high alpine areas that provide these elements, but they are analyzed here to capture any modifications to their home ranges as they have been observed inside the project area.

Spruce-Fir Species – American marten, Boreal owl, Pygmy shrew, Olive-sided flycatcher

These species have been grouped together because of their affinity for spruce-fir forests and the similar affects the proposed actions may have on these species. “In the main Rocky Mountains, martens (*Martes americana*) tend to select for stands dominated by moist-site species like Engelmann spruce and subalpine fir, and select against stands dominated by dry-site species with little physical structure near the ground, including most stands of ponderosa pine and dry stands of lodgepole pine” (Buskirk 2002). There have been several observations of marten on the Leadville Ranger District as well as inside the project area.

Boreal owls (*Aegolius funereus*) are found in mature spruce-fir or spruce-fir and lodgepole pine forest interspersed with meadows (Andrews 1992). Boreal owls have been documented on the district though not inside the project area. However, only limited surveys were conducted for boreal owl for this project and so it is assumed that they are present where suitable habitat exists.

Pygmy shrews (*Sorex hoyi*) are found in “wet conifer forests” with all known locations found in montane or subalpine landscapes dominated by conifer forests and dense stream networks that interact with various bogs, marshes, and other wetlands (Beauvais 2006). There are no records of pygmy shrew in the project area, district, or forest. However, no surveys have been conducted and there is suitable habitat present; therefore, presence is assumed.

The olive-sided flycatcher (*Contopus cooperi*) is associated with mature spruce-fir forest particularly if there are large conifers, bogs, and meadows present, preferring areas with abundant snags (Wrigley 2012). There are records of olive-side flycatcher on the Leadville Ranger District but none known in the project area. Suitable habitat exists so presence is assumed.

MANAGEMENT INDICATOR SPECIES (MIS)

Amendment 30 to The Land and Resource Management Plan for the PSICC (USDA Forest Service 2005) identified four MIS for the Pike and San Isabel National Forests: Abert’s squirrel, brook trout, elk, and greenback cutthroat trout. The White River National Forest (WRNF) has listed the following as MIS: elk, cave bats, American pipit, Brewer’s sparrow, Virginia’s warbler, aquatic macroinvertebrates, and all trout species. All species analyzed are identified in Table 3.14. Species analyzed here will be restricted to effects on each forest. For example, cave bats are a MIS for the White River National Forest only and will only be analyzed if the habitat changes on the WRNF portion of the project affect them.

Table 3.14 Terrestrial Management Indicator Species for the San Isabel National Forest (SINF) and the White River National Forest.

Species	MIS for this forest	Species expected in respective project area?	Habitat affected by project?	Further evaluation as MIS?	Primary Habitat type
Abert’s Squirrel	SINF	No	No	No	mature ponderosa pine
American Pipit	WRNF	Yes	No	No	alpine grassland
Brewer’s Sparrow*	WRNF	No	No	No	sagebrush
Cave Bats	WRNF	No	No	No	caves
Elk	Both	Yes	Yes	Yes	widespread
Virginia’s Warbler	WRNF	No	No	No	Pinyon-juniper shrublands

*Brewer’s sparrow is a MIS for the WRNF and there is no sagebrush in that portion of the project area. Brewer’s sparrow and sagebrush habitat is present on the SINF portion of the project and is analyzed under the sensitive species section.

Rocky Mountain Elk

Rocky Mountain elk (*Cervus canadensis*) are found in the project area year round and tend to inhabit coniferous forests associated with rugged, broken terrain or foothill ranges. During summer, elk spend most of their time in high mountain meadows in the alpine or subalpine zones or in stream bottoms. Elk may use more open areas during spring and summer because of earlier spring green-up (Edge 1987). During hot summer months, elk seek shaded, cool habitats. Use of forage areas depends on proximity to cover. Use is typically concentrated to within 200 to 600 feet of cover edge, but is not exclusive to these areas. Either cover or forage may be limiting to elk, particularly on winter ranges or calving habitats (Rodrick 1991). One study (Cook 1998) illustrated that “it remains

uncertain that thermal cover significantly influences the nutritional condition, survival, or productivity of wild ungulates.” Cook et al. (ibid) found no significant, positive effect of thermal cover on elk condition, and in fact found that “dense cover provided a costly energetic environment, resulting in significantly greater overwinter mass loss, fat catabolism and (in 1 winter) mortality”. Open road densities greater than 1.5 miles per square mile of habitat on summer range or one mile per square mile of habitat on winter range are also considered a limiting factor (Rodrick 1991).

Elk populations in the project area are within population objectives and this is generally true at the statewide scale as well (Grigg 2013). The Tennessee Creek project area lies within Colorado Parks and Wildlife defined elk Data Analysis Units (DAU) E16, E17, and E22. Data Analysis Units generally represent geographically-discrete big game populations and the DAU planning process helps establish herd objectives (Grigg 2011). The White River National Forest portion of Ski Cooper is part of Data Analysis Unit E16 which had a 2011 post hunt population estimate of 7,100 elk; well over the population object of 5,100 elk for this DAU (Mao 2012). The only portion of the WRNF and DAU E16 included in the project boundary is the ski area. The majority of the Tennessee Creek Project is within DAUs E17 and E22 with the west side of the project area in DAU E17 and the eastern portion including the rest of Ski Cooper and Mt. Zion within DAU E22. In DAU E17, elk population objectives designated by the CPW have recently been increased to more closely match the current population to 3,150 - 3,850 (Grigg 2011). The elk population objectives for DAU E22 have also been increased to 3,150 - 3,500 elk to reflect current populations (Vayhinger 2005). Post hunt estimates for 2012 for DAU E17 and E22 are 3,345 and 3,236 respectively (Grigg 2013). This reflects that herds are stable and within desired population objectives. Given the wide distribution, abundance, stable or increasing population trend on the Forest and state in general, and game status of elk, there are no viability concerns at this time as all Data Analysis Units identified by the CPW are within target population goals.

Only a small portion of the Tennessee Creek project area contains mapped winter range. The project area represents less than 0.05 percent and less than 0.005 percent of the elk winter range on the Leadville District and San Isabel National Forests respectively (Table 3.15). There are 2,523 acres of mapped production range within the project as well; some of which overlaps with the winter range portion.

Table 3.15 Potential Elk Winter Range at the Project Area, District, and Forest Scales

MIS Species	Acres of Potential Winter Range on National Forest Lands ¹			
	Project Area ¹	Leadville RD	San Isabel NF ²	PSICC ²
Elk	1,872	58,000	490,000	820,000

¹ Elk winter range obtained from CPW GIS coverage and clipped to the FS ownership.

² Rounded to nearest 10,000 acres

MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (MBTA) was established in 1918 and signed into law under a treaty (convention) with Great Britain to protect migratory birds. Subsequently, additional treaties were also made with Mexico (1936), Japan (1972), and the Soviet Union (1976). Today, over 1,000 bird species are protected under the MBTA. This act prohibits anyone to “*pursue, hunt, take, attempt to take, capture, kill, possess, offer for sale, sell, offer to purchase, deliver for shipment... or export...any migratory bird, included in the terms of this Convention...or any part, nest, or egg of any such bird...*”

Executive Order (EO) 13186 of January 19, 2001 directs the federal government to take a lead role in protecting migratory birds, incorporate bird conservation into agency programs, activities and planning, evaluate the effects of agency actions on migratory birds, minimize take of species of concern, and address habitat conservation.

The U.S. Fish and Wildlife Service has identified 27 species of concern for the Bird Conservation Region (Southern Rockies) in which the Tennessee Creek Project lies (U. S. Fish and Wildlife Service 2008). Many of these species have already been analyzed or excluded from analysis under the sensitive species section while several others would not be expected in the project area.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

FEDERALLY LISTED THREATENED, ENDANGERED AND CANDIDATE WILDLIFE SPECIES

DIRECT AND INDIRECT EFFECTS – NO ACTION

Canada lynx

Since there is no proposal or change associated with this alternative, the effects here are in relation to what is currently happening on the landscape within the Tennessee Pass and Massive LAUs. Due to ongoing projects or natural processes, there may already be effects (positive or negative) taking place.

The natural biological and ecological processes (unrelated to project activities) would continue to cause changes in structural stages and plant community compositions in a dynamic way across the project area. Continued persistence of mature lodgepole with minimal understory development could continue in most places over some time. However, natural disturbances (e.g., fire, insects, disease, wind, and ice/snow damage) would set back seral stages in a patchwork or mosaic fashion over time. Wildland fires that mimic the natural fire regime intensity and severity would aid in improving the long-term biodiversity and heterogeneity of the area. However, wildfires occurring outside of wilderness usually are fully suppressed. Natural disturbances would likely benefit lynx in the project area as well as within the LAUs. Additional mortality of conifer trees through spruce or pine beetle would likely facilitate new growth of regenerative lodgepole and spruce-fir trees. It may take approximately 15 – 30 years (for lodgepole) following forest management practices or fire for conifers and/or brush species to regenerate to heights sufficient to extend above average winter snow levels and create high quality habitat for snowshoe hare (Ruediger 2000). At these elevations, it would likely take longer (40+ years) for spruce-fir to reach these levels.

Tree conditions currently on the forest are vulnerable to insect and disease mortality. The monoculture of mature lodgepole pine coupled with the current drought, which stress trees further, provide precarious conditions for the landscape as a whole. Just north of the Tennessee Pass divide, a major pine beetle epidemic has created mass mortality of the forests in that region. South of the project area in Gunnison and more closely on Monarch Pass near Salida, the spruce beetle has begun its course of reaching epidemic proportions as well. So as small scale, endemic outbreaks could contribute to a diverse landscape, the conditions are such that die-offs would likely be of epidemic proportions, thereby facilitating a continuation of homogenous landscapes. However, it is impossible to predict the frequency and duration of natural disturbances. Some disturbances could happen at most anytime and others may not occur for decades or even a century or more. Lynx have

evolved with smaller and large landscape disturbances (e.g., fire, wind, insects, and disease) and have adapted to these landscape dynamics.

The continuation of small-scale treatments inside the project area may or may not contribute to an increase in foraging (when regeneration occurs) for snowshoe hare, the primary prey of Canada lynx. Some of the treatment areas (portions of the NWHF and Turquoise Lake and Halfmoon Creek campgrounds) are not in lynx habitat or have proposed thinning treatments which may not open up the forest floor enough to promote much regeneration.

Continued fire suppression contributes to the continuation of forests with little age or species diversity. Crown cover continues to develop, blocking light from the forest floor, which prohibits much, if any, regeneration or development of grass, forbs, and shrubs in forested areas.

Recreational disturbances currently occurring within each LAU and within the project area specifically would continue to impact lynx to various levels. Areas are likely avoided by lynx currently due to high number of people (e.g., Ski Cooper and Turquoise Lake and Halfmoon Creek campgrounds) but in other areas where recreation is more dispersed, lynx may not be impacted as much. Generally, lynx are somewhat tolerant of human presence and most investigations of lynx have not shown human presence to influence how lynx use the landscape (Ruediger 2000).

The above ongoing activities have incrementally impacted Canada lynx directly, indirectly, and cumulatively through fragmentation, habitat loss, and loss of effectiveness through human disturbance of their habitats. Because lynx habitat is constantly changing and evolving through natural processes/disturbances or the actions discussed above, the no action alternative “may affect, is not likely to adversely affect Canada lynx.”

North American Wolverine

Since climate change may have negative effects on suitable habitat for wolverine (less snowpack available for denning), the continuation of increased temperatures could affect the quality and quantity of wolverine habitat on the Leadville and Holy Cross Ranger Districts. In the southern portion of wolverine range in North America, wolverines are constrained by their need for cold conditions and persistent spring snow to using only the coldest available landscapes (Copeland 2010). Though climate change can be expected to have effects on wolverine habitat, the severity and probability cannot be certain. Spring snow cover and the bioclimatic niche that it indicates, is likely to continue to be strongly impacted by global climate change (Mote 2005), threatening wolverine throughout their geographic distribution. Reductions in spring snow cover associated with climatic warming will likely reduce the extent of wolverine habitat, with an associated loss of connectivity (Copeland 2010).

The continuation of increased recreation into high elevation, alpine habitats may disturb wolverines where historic levels of human presence were previously low. Backcountry travel, both motorized and non-motorized, is becoming increasingly popular and recreationists are able to access virtually any terrain, including high alpine habitats, with improved performance of snowmobiles. Though much of what would be considered quality habitat on the Leadville and Eagle Ranger Districts is located in wilderness where snowmobile use is prohibited, there are still other alpine areas that are impacted by winter motorized and non-motorized recreation. Because of past and current recreational use in these high alpine habitats and the continuation of increased temperatures due to

climate change, the no action alternative is “not likely to jeopardize the continued existence” of wolverine.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 1 (PROPOSED ACTION)

Canada lynx

The Tennessee Pass LAU and Massive LAU have 19,953 and 22,144 acres of modeled lynx habitat respectively (USDA Forest Service 2013). Table 3.16 shows the amount of lynx habitat for the Pike-San Isabel National Forests as well as within each LAU, within the project area, and the acres of proposed treatments. If it has been mapped as lynx habitat, it will be treated as such regardless of tree species while acknowledging the fact that some lynx habitat may be of higher quality than others (dense spruce-fir vs. more open seral lodgepole pine).

It should be noted up front that all implementation proposals and analysis thereof, **assume** that all treated acres within this proposal are lynx habitat. This is being done because implementation locations are not being pre-determined and therefore, it cannot be determine how many acres of lynx habitat would actually be affected. Though much of the project area is mapped as lynx habitat, approximately 6,870 acres is not and the quality or effectiveness of each stand is not specified. There are approximately 9,480 acres of mapped lynx habitat in the project area. To err on the side of caution and conservation, this analysis assumes this hypothetical situation; that all 9,480 acres of lynx habitat out of the total 13,580 treatable acres within the project would be treated. However, in reality the number of treated acres would be less, but it cannot be quantified at this time. Acres that are actually treated in lynx habitat would be tracked and reported annually to the U. S. Fish and Wildlife Service according to reporting requirements outlined in the Southern Rockies Lynx Amendment (SRLA).

Table 3.16 Acres of Lynx Habitat Proposed for Treatment

	Pike/San Isabel NF	Tennessee Creek Project Area	Tennessee Pass LAU	Massive LAU
Total Acres	2,232,600	16,450	42,378	49,446
Lynx Habitat	897,306	9,480	19,953	22,114
Treatable Acres	-	13,580	6,640	6,940
Clear Cut Acres	-	2,485	1,158	1,327
Thinning Acres	-	7,110	3,300	3,810

Ruggiero et al. (2000) states that areas of regenerating forest created by natural or anthropogenic sources can provide important hare habitat, but they are temporally transient. They suggested that forests managed for lynx should contain a mixture of age classes and structural conditions – the intent of the Tennessee Creek Project. Treating the area in a manner that would promote a diversity of age classes and structural conditions would reduce the likelihood that insects or diseases would impact the whole area at any one time, therefore promoting future diversity and heterogeneity as well as near-term biodiversity development. Areas of high biodiversity currently on the landscape would be retained as part of the “reserves” planned for the project. Thinning would be conducted in a mosaic fashion that would mimic natural disturbances.

Effects of Harvesting – Clear cuts

Lodgepole pine tends to “prune” itself as it matures. The crown “lifts” and branches lower to ground level are not available as foraging for snowshoe hare (see photo below). Areas that are climax lodgepole (lodgepole stands with a less than five percent of spruce-fir component) or mature monocultures of lodgepole pine are not considered lynx habitat. These are the areas within the project area that would be targeted for treatment and would not have an effect on snowshoe hare or lynx use other than a slight beneficial increase in foraging habitat due to regenerating forests should these stands be adjacent to lynx habitat.



Typical lodgepole pine stand that has “pruned” its low lying branches. Photo by J. Windorski.

Clear cuts would generally be located in areas that have marginal to poor horizontal cover for snowshoe hare. In areas where openings are created or augmented it is expected to take around 15 – 30 years before lodgepole pine regeneration provides winter foraging habitat for snowshoe hare, lynx primary food source. Treatment activities would open up the forest floor for increased production of grasses and forbs and eventually regeneration of trees. Emphasized areas would be those next to spruce-fir stands as well as adjacent to aspen stands to enhance the vigor and growth of those species. Forests that are growing back after fire or logging often provide excellent food and cover for hares and therefore may attract lynx. This could increase or improve snowshoe hare winter forage habitat beginning in the next 2 – 3 decades or more as dense horizontal cover develops in harvested areas, ultimately benefitting lynx in the mid-term.

Proposed activities would convert an approximately 1,160 acres (less than 6 percent) and 1,330 acres (6 percent) of lower quality lynx habitat (habitat with less than 35 percent dense horizontal cover) within the Tennessee Pass and Massive LAUs to currently unsuitable for the next approximately 15 – 30 years where clear cuts are proposed. The timeline for implementation is stretched out over the next 10 years and treatment locations would be scattered throughout the entire project area. Meaning, all the clear cuts would not be implemented all in one location, all at the same time; rather scattered throughout the 16,450 acres over a 10 year time period. Converting

the above percentage of lynx habitat to unsuitable is likely to have some short to mid-term (0 – 30 years) negative effects on lynx due the size, scope, and location of this project at the LAU scale.

As unsuitable habitat regenerates, it would provide a new cohort of regenerated forest habitats in an uneven-aged mosaic of older forests that would provide snowshoe hare foraging habitat in about 15 – 30 years following harvest. Foraging benefits overall (10 year implementation timeframe) could be realized 20 – 40 years from now and longer. Prescribed burning in some or all of the aspen treatment areas could very likely enhance the regeneration beyond cutting or clearing the small diameter trees alone.

The proposed harvesting treatments would likely result in less woody debris being available on the forest floor for both lynx denning opportunities and less structure for lynx prey. Denning habitat would likely take 150+ years to recover. According to the LCAS, red squirrel habitat is defined by coniferous forests of seed and cone-producing age that usually contain snags and downed woody debris, generally mature or older forests. This characteristic is often found in spruce-fir forests which will not be treated but can also be found in lodgepole pine forests. In Colorado, 66.4±5.6 percent of annual documented kills by lynx (n=604) were hares, varying annually from 30.4–90.8 percent, while an average of 22.6±5.7 percent were red squirrels (Shenk 2009). Harvesting mature, cone-producing conifer trees could reduce food available for red squirrels, causing them to expand their home ranges to satisfy nutritional needs. In areas targeted for clear cutting, red squirrel habitat would become unsuitable until the trees became of cone-producing age again, causing squirrels to move to adjacent suitable habitat. Targeted areas are located in non-lynx habitat or lower quality habitat (climax or seral lodgepole stands). Before the units regrow to ages suitable for red squirrels, the regenerating trees would provide excellent forage for snowshoe hares, the main prey species of lynx. Project design criteria requires retention of an average of at least 200 linear feet of the largest diameter wood available per acre and biologically important trees (squirrel middens) would remain intact. Some areas with closed canopy with substantial quantities of coarse woody debris would be incorporated into “reserve” areas between treatments and could be targeted around middens to protect squirrel habitat. All partially decomposed coarse woody debris would remain on site. Table 3.17 lists the amount of suitable lynx habitat pre- and post-project implementation. This is based on the hypothetical situation in which all treated acres were lynx habitat. This table displays the amount of clear cut acres that would temporarily change suitable habitat to “unsuitable” habitat until the regeneration has grown enough to be available to snowshoe hare above the level of the snow (approximately 15 – 30 years after treatment).

Table 3.17 Approximate Acres of Canada Lynx Habitat Present in the Tennessee Pass and Massive LAUs and Proposed Changes to Lynx Habitat

	Pike and San Isabel NF	Tennessee Creek Project Area	Tennessee Pass LAU	Tenn Pass LAU Post-treatment	% Change	Massive LAU	Massive LAU Post-treatment	% Change
Total Acres		16,500	42,390			49,500		
Lynx Habitat	897,306	9,480	19,953	-1,160	6%	22,114	-1,330	6%

Denning habitat would be lost or degraded, should it exist in clear cut areas for 100+ years until a mature overstory develops and large woody material re-establishes at the site. Even though design

criteria require appropriate amounts of downed logs or piles to remain on the landscape, it would not likely be enough to be considered quality denning habitat. Denning habitat usually consists of whole logs with attached root wads, jack-strawed logs, and boulders often found on north or east facing slopes. Mature spruce-fir stands are typical of providing higher quality denning habitat than lodgepole stands and would not be harvested under this proposed action (other than a possible salvage harvest and then 10 percent of the dead trees would remain for quality lynx denning habitat).

Though aspen communities make up a small portion of the project area, they provide important habitat diversity and would be treated to improve the health and vigor of these stands. Ruediger et al. (2000) states that aspen may substantially contribute to prey productivity, while regenerating burns are often quite productive and the resulting conditions provide excellent habitat for snowshoe hare and other prey species.

Effects of Harvesting – Thinning

In areas where thinning would be implemented, the lynx habitat may be temporarily degraded until young trees fill in, but would not be completely converted to “unsuitable.” Many of these areas proposed for thinning are not likely higher quality lynx habitat to begin with and the thinning treatments may increase dense horizontal cover through regeneration of young trees in 15 – 30 years. The response of regeneration would depend on how much a stand would be opened up to allow more light to reach the forest floor. Stands that already have dense horizontal cover (greater than 35 percent), would be retained as quality lynx habitat and would not receive treatment. Generally, the effects of thinning, depending on if the stand is thinned enough to allow regeneration, would increase foraging opportunities for snowshoe hare, and therefore lynx, as young trees fill in where the mature lodgepole pine were removed.

Thinned areas could reduce the quality of red squirrel habitat by removing cone-producing trees, though the “un-even” age management style proposed provides for a variety of age and species classes. In thinning areas, design criteria require specified numbers of snags and coarse woody debris to remain on the landscape following treatment, both important in squirrel habitat. Middens would also be incorporated into reserve areas. Though the quality of foraging habitat for squirrels may be degraded in some thinned areas, there would remain sufficient amounts of cone-producing trees within and adjacent to treated areas to sustain squirrel populations.

Some pre-commercial thinning would take place in stands that were clear cut 20 – 30 years ago. From looking at the lynx habitat map (USDA Forest Service 2013) in conjunction with the location of these old clear cuts, it can determine how many acres are in lynx habitat and how many are located in climax lodgepole stands. Within the Tennessee Pass LAU, there are 34 acres within lynx habitat that are proposed for pre-commercial thinning and within the Massive LAU there are approximately 31 acres within lynx habitat proposed for this treatment. These figures constitute 0.2 percent of lynx habitat in the Tennessee Pass LAU and 0.1 percent of lynx habitat within the Massive LAU that would be pre-commercially thinned. This is consistent with Exception 5 of Standard VEG S5 of the SRLA. Depending on the degree of pre-commercial thinning, lynx winter foraging habitat could be improved (regeneration is increased and crown lift is delayed) or degraded (not enough trees are removed to promote regeneration thereby removing foraging habitat).

Incidental damage to snowshoe hare winter foraging habitat (due to mechanical trampling and ground disturbance of the seedling and sapling sized trees) from harvest and salvage activities would convert some treated areas into currently unsuitable lynx habitat for the next 15 – 30 years, though these acres would be included in the footprint of the treatment units and would not be additive beyond the acres already designated for treatment. Damage to any portion of lynx habitat that creates a measurable opening or conversion of lynx habitat from harvest equipment would be tracked and recorded as incidental damage and would count towards any limits imposed by the SRLA.

Thinning, salvaging, patch cutting, and removal of trees in some of the dense-canopied overstory stands of lynx habitat, primarily areas with very little understory vegetation, should improve the opportunities for developing an understory that provides snowshoe hare summer and winter foraging habitat (1 – 2 years for summer foraging; 15 – 30 years for winter foraging habitat) due to less competition for light, moisture, and nutrients.

Other Vegetative Actions

Salvage treatment would take place in the event that spruce beetle or other insects and diseases impact spruce forests. Spruce trees that are dead are not considered lynx habitat and therefore removing them would not count toward acre or percentage limitations set forth in the Southern Rockies Lynx Amendment. Currently there is no need or intent to treat any spruce-fir stands.

New temporary road construction and re-construction of old logging roads would turn approximately 21 miles (approximately 38 acres) of vegetated habitat possibly functioning as lynx habitat into unsuitable habitat. These 38 acres would be in addition to proposed clear cut acres, but would not substantially change percentages of lynx habitat converted over any LAU. The assumption is that all roads would be constructed in lynx habitat since the locations are not predetermined; the actual acres converted would be less. These temporary roads are not intended to remain open or be in use long-term. They would be rehabilitated and allowed to recover after implementation is complete. Depending on the method of closure (e.g., rip and seed or boulder and slash) the habitat may or may not return to pre-road construction levels, but would not be maintained permanently as non-habitat.

Temporary roads could also lead to some new snow compaction and potential competition from carnivores should the public use them during the winter. Compiled information in the revised Lynx Conservation Assessment and Strategy (LCAS) regarding studies of coyote use on compacted snowmobile trails has yielded variable results. “It appears that snow column density and the number of freeze/thaw events in different regions may influence coyote movements and habitat selection (Burghardt-Dowd 2010). That is, snow penetrability in the region may determine whether or not snowmobile trails influence coyote movement patterns in lynx habitats (Bunnell 2006) (Kolbe 2007) (Burghardt-Dowd 2010)”. Also “existing information suggests that some low level of competition for prey could occur naturally between lynx and coyotes. However, this is apt to vary spatially or temporally depending on overall prey availability and composition. Research that could conclusively demonstrate and quantify the effects of competition would be challenging due to numerous confounding factors.” (Interagency Lynx Biology Team 2013). It is unknown as to whether or not the temporary roads will be used and compacted by the public facilitating competition during the winter. It is unlikely as the appeal to snowmobile on a spur road for less than a mile is not typical in this area (district employee observations). Most snowmobilers travel on main routes (already on the

compaction map) or to high elevation meadows and alpine play areas via these main routes. If temporary roads created by this project are used in the winter (by the public), it could have disturbance/displacement impacts, potentially facilitate competition by other carnivores, and contribute to a loss of habitat effectiveness should lynx be in the area. Again, temporary roads would be gated from public use, but during the winter, it could be difficult to prohibit use as snowmobiles are not restricted to roads.

Tree planting, which is proposed within Ski Cooper, would have a beneficial effect to snowshoe hare foraging habitat. Planting spruce-fir trees that are already approximately one foot tall slightly shortens the time for an area to return to foraging snowshoe hare habitat on its own – estimated to be 30 – 40 years before the trees are above the average snowline and available to hares in the winter as forage.

Prescribed Fire

Burning in forested areas would reduce canopy cover and ground cover causing a reduction in snowshoe hare winter and/or summer foraging habitat in the short term (0 – 15 years). Conversely, fires often produce more snags on the landscape that eventually fall and become downed woody material that could provide additional denning habitat. Prescribed fire is a tool used to mimic natural ecological processes and would create a mosaic of biological diversity in the long-term (15+ years). Broadcast burning would not take place in spruce-fir stands or in sagebrush communities. Pile burning would be appropriate in these habitats if necessary to treat slash after a salvage treatment.

Disturbance/Displacement

Project-related activities could cause some avoidance or displacement-type of impacts to lynx in the event that lynx were in the area during project implementation activities due to smoke, prescribed fire, noise, personnel, road re-construction activities, project-related vehicular traffic, and equipment operations. Disturbance from harvest activities could result in displacing lynx from the general area in the short-term during project implementation periods for the life of the project. Winter hauling could occur but would not result in increasing the amount of snow compaction in the LAU as all major identified haul roads are already currently being compacted by the public and are on the lynx snow compaction map. Any winter skid trails associated with the major haul roads would be very small in overall compaction during any given winter and would be temporary in nature. All temporary roads would be restricted (e.g., gates) so that the public would not be able to access the area.

Harvest activities could occur intermittently year-round but primarily during the summer and fall with some pile burning in winter months. Prescribed burns generally take place in the fall and spring, depending on fuel conditions. Even though there is a possibility of disturbance/displacement effects from the project related activities, there is evidence that lynx are somewhat tolerant of humans (Ruediger 2000). It should also be noted that there are no seasonal restrictions on project related activities in any type of lynx habitat according to the Lynx Conservation Assessment and Strategy (Ruediger 2000). Several studies of lynx have been conducted in areas of relatively dense rural human populations and agricultural development, suggesting that lynx can tolerate moderate levels of human disturbance (Ruggiero 2000).

Other proposed actions

Numerous other actions have been proposed in Alternative 1 other than vegetation management. These projects would improve riparian habitats and would not alter or remove any lynx habitat during implementation.

The snag creation would improve habitat for cavity-dependent wildlife. These snags would eventually fall and become downed woody debris but would not likely create substantial amounts of downed logs typical of quality denning habitat, but may provide refuge for red squirrels, lynx secondary prey species. Substantial road maintenance that may be required to accommodate logging traffic on FSR 109 would have little, if any, impact to lynx or lynx habitat. Though there may be one acre of disturbance in the re-contouring of FSR 109, it is not within lynx habitat. The only effects to lynx from this proposal would be the temporary noise and sight disturbance in the immediate area caused by people and machinery. Implementation for these projects is likely to be very short in duration (one day to several weeks) depending on the project. As mentioned above, lynx tend to be fairly tolerant of human activity and could easily disperse to adjacent areas.

Modification of lynx habitat from project activities that are designed to mimic natural patterns and scale, would likely provide for improved opportunities for lynx in the long-term (15 – 40+ years) as treatment types are consistent with those recommended in the Southern Rockies Lynx Assessment and Lynx Conservation Assessment and Strategy. Tree harvesting could have some direct short-term (0 – 15 years) negative effects on lynx winter foraging habitat in each LAU due to a reduction in the amount of winter habitat post-project implementation. However, there likely would be a future (15 – 30 years) increase in lynx winter foraging habitat in areas where clear cuts and patch cuts are created and the forest canopy is opened up. This would allow for increased quantities of grass, forbs, young trees and shrubs. Opening up the landscape with clear cuts and/or prescribed burning also temporarily increases habitat fragmentation, which degrades the effectiveness and quality of lynx habitat.

“Direct habitat effects of fragmentation of most concern in lynx conservation are (1) reduction of area and patch size of late-successional forest and optimal snowshoe hare habitat; (2) creation of openings that facilitate access by potentially competing carnivores; (3) increased densities of edges between early successional and other forest types; and (4) changes in the amount and structural complexity of seral forest stands within landscapes.” (Ruggiero, et al. 2000). The Tennessee Creek project could, through fragmentation, facilitate access by potentially competing carnivores and increase densities of edges between early successional and other forest types. It is unknown as to whether or not the temporary roads will facilitate competition during the winter but it is unlikely as the appeal to snowmobile on a spur road for less than a mile is not typical in this area. Most snowmobilers travel on main routes (already on the compaction map) or to high elevation meadows and alpine areas via these main routes. Patch size of optimal snowshoe hare habitat (spruce-fir and stands with >35 percent DHC) would not be reduced because these areas are excluded from treatment. The structural complexity of seral forest stands would be increased because of this project by cutting mature lodgepole pine to provide for species and age diversity on the landscape. The possible increased density of edges could degrade habitat quality for lynx in the areas targeted for clear-cutting. Again, lower quality lynx habitat and non-lynx habitat are targeted for this kind of treatment.

Because treatments are designed such that they are spread out over the project area, it is unlikely movement throughout the LAU or linkage area would be hindered. *All high quality lynx habitat would be retained as important refuge and excluded from direct treatment.* Much of the project area is directly adjacent to wilderness areas that provide quality refuge next to, but away from the project area.

The SRLA consistently discusses the impacts that 2-4 lane **highways** have on lynx connectivity and linkage areas. *“Risk factors affecting lynx movement include barriers to movements such as **major highways** and associated development with rights-of-way Private land development, especially along road corridors in mountain valleys, may also fragment habitat and impede movement of lynx. Urban expansion and development on private land has further fragmented an already patchy distribution of lynx habitat, many times in response to development or expansion of a developed recreational facility on NFS lands within lynx habitats.”* (U. S. Forest Service 2008). Increased fragmentation and isolation has occurred due to cumulative impacts from highways and residential and recreational development often tied to ski areas developed on National Forest System lands (Hickenbottom 1999). Connectivity provided by linkage areas can be degraded or severed by human infrastructure such as high-use highways, subdivisions or other developments.” (Ruediger 2000).

Vegetation management could also lead to compromised habitat connectivity depending on the nature of the treatments and juxtaposition to linkage areas. The SRLA does not provide a specified measure or amount to quantify adequate habitat connectivity. We assume that the risk factors (highways, private land developments, new ski areas etc.) listed by experts above are to be avoided in order to maintain connectivity. Though vegetation management from this project and the associated activities (temporary roads) would potentially degrade lynx habitat quality in the short term, it would not cause the impacts to the degree that new developments, highways or ski areas would. Temporary roads that would be constructed due to this project would receive extremely low traffic volume and speeds; would be typically less than 1 mile long; and would not lead to associated development. It would be extremely unlikely that lynx would avoid crossing or be killed on a single-lane, low traffic, low speed, dirt road. Per the ROD in the SRLA (U.S. Forest Service 2008), “Unlike high-speed highways, the types of roads managed by the Forest Service do not have the high speeds and high use levels that would create barriers to lynx movements or result in significant mortality risk.” Project design and design criteria mitigate the degradation of lynx habitat by concentrating treatments in lower quality habitat and improving the foraging capability of those. Reserve areas would be left on the landscape as refuge for wildlife species. Reserve areas would be located throughout the project area and would consist of steep areas (greater than 35%), inaccessible areas, and wet areas. In mapped lynx habitat, stands with greater than 35% dense horizontal cover would also be retained and no spruce/fir stands would be treated. Lynx are tightly associated with spruce/fir stands. In addition to this, approximately 10 percent of the areas identified for thinning would be left as reserve areas. There would be at least 200 feet distance between adjacent clearcuts to provide secure travel corridors for wildlife. Thinning and prescribed fire treatments may occur within some of the corridors, while others would remain untreated. Old growth, areas with closed canopy or with substantial quantities of coarse woody debris would be targeted and incorporated into reserve areas between treatments and areas containing important wildlife habitat features such as squirrel middens. The high quality lynx habitat (spruce/fir stands and stands with >35% DHC) will not be treated. In those areas identified for treatment but also in mapped lynx habitat (seral lodgepole stands), the result will be a matrix of diversified forest with openings of various sizes, irregular thinning, un-even aged management, and reserves.

According to the SRLA, landscape connectivity may be provided by: (a) narrow forested mountain ridges and plateaus connecting more extensive mountain forest habitats, (b) wooded or willow riparian communities providing travel cover across open valley floors between mountain ranges, or (c) lower elevation ponderosa pine, pinyon-juniper woodlands or shrublands that separate high elevation spruce-fir forests. (U.S Forest Service 2008). The Tennessee Pass linkage area was designated because it “provides major connections between blocks of habitat, tying the Sawatch Range to Summit County and into a habitat block near Vail Pass. It includes a portion of Fremont Pass and connects the Snake and Arkansas River drainages.” Inside of this linkage area lays Ski Cooper and Highway 24, both entities that cause habitat fragmentation and degradation of connectivity. However, there is still nearly 3 miles of suitable habitat to the west of Highway 24 and the project boundary on Tennessee Pass still within the linkage area that would provide for the “narrow forested mountain ridge that connects extensive forest habitats” as stated above. Though the SRLA does not specify exactly what “narrow” means, it is assumed that a width of almost 3 miles of suitable habitat on the pass would be sufficient to accommodate traveling lynx between larger blocks of habitat. Riparian areas (also identified above as suitable for providing connectivity) would also be protected and buffered from treatments and would not change due to this project. The third suggestion above for providing connectivity (lower elevation ponderosa pine) does not apply to this project as there is not that habitat type available here.

Because this project (1) does not create new highways, ski areas, or new private land development (the three major things identified as hindering connectivity), (2) there is sufficient amounts of suitable habitat left on the landscape providing connectivity as suggested by the SRLA, (3) there are no treatments in high quality lynx habitat (spruce/fir and any stands with >35% DHC), and (4) treated areas (located in lower quality lynx habitat; seral lodgepole pine stands) provide a mosaic of gaps, dense areas, openings, thinned areas, and reserves; this project will maintain connectivity on the landscape as well as within the linkage area.

Tennessee Creek Project has been designed to improve lynx foraging habitat where horizontal cover is lacking, protects high quality lynx habitat stands, does not prohibit movement throughout the LAUs or linkage areas, and promotes biological diversity (age class and species diversity) by mimicking natural disturbance patterns. The proposed action is consistent with all SRLA conservation measures. The effects to Canada lynx would be minimal, insignificant (immeasurable and would not reach the level of take), and discountable (extremely unlikely to occur). Based on the above rationale Alternative 1 “may affect, not likely to adversely affect” Canada lynx.

North American Wolverine

In addition to the effects listed above for the No Action Alternative, Alternative 1 could cause some anthropogenic disturbance during implementation should wolverine be in the area. It is extremely unlikely that upper elevations within the project area would be harvested during the winter or spring (denning season) and would therefore not have an impact on snowpack or wolverine denning in the area. Though there are areas within the project area that have persisting snowpack into May, these areas currently receive high recreational use (Ski Cooper) during the start of denning season and are unlikely to provide the solitude normally preferred by wolverines. Wolverines do not appear to specialize on specific vegetation or geological habitat aspects, but instead select areas that are cold and receive enough winter precipitation to reliably maintain deep persistent snow late into the warm season (Copeland et al. 2010). Winter range for ungulates (food source for wolverine) would be improved in places by opening up the forest canopy and allowing more forage to grow. Timing

restrictions for timber harvest activities in winter range are part of the design criteria and would protect wintering big game species. The proposed action would not contribute to loss of persistent snowpack nor would it cause a reduction in food source for wolverine. Based on this and ongoing climate change, Alternative 1 determination would “not likely jeopardize the continued existence” of wolverine.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 2

Canada lynx

This alternative would have similar effects to lynx habitat as those discussed in Alternative 1 but with higher levels and degrees of effects. The biggest change would be that more acres would be clear cut (3,970 acres) and less acres overall would be thinned (3,030 acres). More aspen would be clear cut, promoting more regeneration within that type of habitat. The amounts of pre-commercial thinning, treatments in spruce-fir and all other actions listed above in Alternative 1 would remain the same and would have identical results and effects for this alternative. There would be more short-term (0 – 30 years) negative impacts to lynx habitat (most notably, snowshoe hare winter foraging habitat) because of the higher amounts of clear cuts though total acres overall (clear cutting plus thinning) would be much less. Lynx habitat would be more fragmented due to more openings throughout, as approximately 9 and 10 percent of lynx habitat within the Tennessee Pass and Massive LAUs would be converted to “currently unsuitable” until the regeneration grows enough to be available above mean snow levels for snowshoe hare. However, there could also be *more beneficial* long term (50+ years) winter snowshoe hare foraging habitat opportunities from the increase in regeneration in areas of poorly-developed dense horizontal cover and otherwise marginal forage habitats.

Alternative 2 would have similar results as those described for Alternative 1 except to a higher degree of effects. There would be more openings created throughout the landscape, essentially providing fewer reserve areas for lynx, though less land would be treated overall. Though the degree of effects would be higher because of more clear cuts, it is unlikely that the effects would reach the level of take. Therefore, Alternative 2 “may affect, not likely to adversely affect” Canada lynx.

North American Wolverine

The effects on wolverine from Alternative 2 would likely be very similar to those discussed above for Alternative 1. The difference between the two alternatives is a change in the number of acres proposed for clear cutting and thinning. Alternative 2 still would not contribute to loss of persistent snowpack nor would it cause a reduction in food source for wolverine. The determination for Alternative 2 would be “not likely to jeopardize the continued existence” of wolverine.

CUMULATIVE EFFECTS

Canada lynx

Many non-federal activities, both on and off-Forest, have occurred in the past and are part of the baseline. Many however, are ongoing and are reasonably expected to continue to occur in the foreseeable future within the analysis area, and may continue to affect lynx in the future as well. These activities and the resulting impacts are considered as cumulative effects for lynx.

Specific cumulative effects from different activities have varying effects to lynx and their prey and habitats. Ruediger et al. (2000) discussed the following cumulative effects specific to lynx.

“The basis of cumulative effects analysis is that the combined number, type and juxtaposition of human activities and natural disturbances may have a significant effect, even though each individual action appears to have minimal effects. Assumptions include:

1. Lynx can persist in most situations with some level of human activity.
2. Human activities and alteration of habitat decrease habitat quality and lynx use of habitat, but the thresholds are not known.
3. Areas without high human activity levels are likely more favorable to lynx.
4. Habitat connectivity is important to lynx conservation” (Ruediger 2000).

It appears likely that climate change may affect some specialized species like Canada lynx over the long term by altering the extent of deep snow habitats preferred by lynx. Kerr and Packer (1998) used the general circulation model developed at the Goddard Institute of Space Sciences for the Intergovernmental Panel on Climate Change to predict future mammal diversity patterns in Canada. Based upon their analysis they predicted that at least 25 mammal species, including Canada lynx and other species addressed here, are limited by the Arctic Ocean in their ability to disperse northward and are likely to undergo significant losses of habitat (Kerr and Packer 1998). For example, features of the snow may also influence lynx interaction with snowshoe hare. Since the effects of climate change are occurring over relatively long periods, the effects on lynx over the short term (10 – 15 years) are less clear. More focused research is needed on the effect of climate change on specific threatened and endangered species such as the Canada lynx and other species, to more accurately predict specific effects of climate change in the Southern Rockies.

Of particular concern for lynx is that a substantial amount of public recreation currently occurs over the analysis area – not just in mapped designated snow compaction areas. The impacts from these activities to this species are increased considerably from this additive use. A substantial amount of winter public snowmobile use is taking place unrestricted over the entire District (outside of Wilderness Areas). For example, an average of approximately 75 – 90 percent of the overall recreation use on the District and between 50 – 90 percent of the winter recreation use is from public recreation activities. Snow compaction by the public in these areas and other areas on the District regularly occurs outside areas of the designated snow compaction areas (areas mapped in 1999 – 2000). Public use during the winter is widespread over the District (depending on snow condition) and their use is currently not regulated by the Forest Service or restricted to designed snow compaction routes. This increases in orders of magnitude the impacts from snow compaction, noise disturbance, and numerous other impacts from these and other recreation activities as discussed above for lynx and their prey. Nighttime use by the public further restricts foraging opportunities and movement of lynx within these areas. The impacts from these activities to this species are increased considerably from this additive use.

Public uses are expected to expand into other areas as snowmobile technologies improve performance, increasing their effects on lynx and their habitats and connectivity within and between LAUs. The effects of general public winter and summer uses could be substantial in the future. Given the existing and anticipated annual increase use in public use, these recreation activities may further impact lynx movement during the daytime and hinder lynx movement during the evening. This would cause disturbance reducing the value of diurnal security areas, potentially prohibit the establishment of natural den sites, and decrease the quality of winter foraging habitat within some

areas, particular in key high elevation forested mountain pass habitat areas.

Future non-motorized activities by the general public occur frequently in roadless, remote backcountry locations (e.g., horseback, hiking, snowshoeing, and skiing). Effects of these recreation activities vary and depend on the type of activity. Each of these activities have and will continue to incrementally further impact lynx directly, indirectly, and cumulatively through habitat loss, fragmentation, and loss of effectiveness through short and long-term disturbances.

The amount of recreation events occurring in the analysis area is increasing and this trend is expected to continue as recreation in the Upper Arkansas River Valley increases in the future. Frequent and intense recreation activity may influence the way lynx respond and use the surrounding environment (Ruediger 2000). Events and services occurring on state, city, county, and private lands primarily occur in developed residential areas outside habitat for lynx. These activities typically occur on the periphery of LAUs overlapping the District, and are located away from large habitat blocks described above. They are outside wilderness and roadless areas on National Forest lands where there is habitat for the lynx. Their influence on lynx is limited to impacts to small, isolated, or peripheral stands of potential habitat and potential disturbance of lynx that may be traveling through the area. The increase in highway travel associated with recreation events can contribute an incremental increase in potential impact to lynx from road collisions, although many roads and highways that provide access to where these events are held are already above the daily threshold of traffic volumes identified in the Lynx Conservation Assessment and Strategy that can negatively impact lynx (4,000 vehicles per day).

This action would add slightly and incrementally to the cumulative effects to this species. These cumulative effects include recreation (e.g., hiking, biking, camping, hunting, boating, and horse riding), road maintenance, vehicle traffic, and the ongoing Northwest Leadville Hazardous Fuels Project which is inside the project area. Previous activities include: access and roads, timber management, recreation, water development, and mining related actions. The proposed action would add to these effects.

North American Wolverine

Many non-federal activities, both on and off-Forest, that have occurred in the past and are part of the baseline. Many are ongoing and are reasonably expected to continue to occur in the foreseeable future within the analysis area and may continue to affect wolverine in the future as well. These activities and the resulting impacts are also considered as cumulative effects for wolverine. Of particular concern for wolverine as discussed above is the continuation of climate change.

FOREST SERVICE SENSITIVE SPECIES

DIRECT AND INDIRECT EFFECTS – NO ACTION

Riparian Habitat Species – Boreal Toad, Northern Leopard Frog, and River Otter

Riparian areas would remain functioning as they are today. There would be no vegetation management under this alternative, thus no impacts would occur from vegetation manipulation. Recreation use would continue to impact riparian habitats. Some areas have been degraded by recreational use (e.g., trampling, soil compaction, and road and trail crossings) and would continue to effect riparian species and their habitats. Continued recreation (camping) within and near riparian

habitats further degrades habitat conditions and water quality. Recreation in these areas also raises the potential of contact with humans and frog or toad populations, increasing the threat of the spread/introduction of *Batrachochytrium dendrobatidis* and other diseases, as well as the capture of individuals. Because of the ongoing degradation of riparian habitats from recreational activities discussed above and effects addressed in the cumulative effects section the no action alternative “may adversely impact individuals, but not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing” of the boreal toad, northern leopard frog, and river otter.

Sagebrush Species – Brewer’s Sparrow

Currently many conifers and aspen are encroaching into remnant sagebrush and grasslands as successional processes gradually convert them into forests. These processes would continue overtime, decreasing the amount and quality of these important habitats in the long-term. However, sufficient refuge and unaffected habitats exist in the analysis area and elsewhere. The amount of sagebrush in the project area is very minimal and the continued encroachment overtime would not have a noticeable effect in the project area. The viability and distribution of the Brewer’s sparrow within the planning area would not be substantially affected. Because of the reasons stated here, the No Action Alternative would have “no impact” on the Brewer’s sparrow.

Aspen and Douglas fir habitats – Flammulated Owl

Under this alternative, larger trees would continue to develop and these forests would develop into older-ages and late-successional forests with multi-layered canopies and a high degree of structural diversity. Habitat complexity would also continue to increase as these forests age into later seral and old-growth forests. There would be no additional or new disturbances from increased human activity associated with any vegetation treatments or prescribed fire. Because suitable habitats would continue to develop into old growth stands and there would be no direct affects from human activities, the No Action Alternative would have “no impact” on flammulated owl.

Lodgepole Pine Habitat Species – Northern Goshawk, Bald Eagle, Hoary Bat, and Rocky Mountain Bighorn Sheep

The No Action Alternative would have no direct impacts on goshawks, bald eagles, hoary bats, bighorn sheep or their habitat. However, there could be some mid- to long-term (5 – 50+ years) indirect effects if large areas of the forest succumb to beetle mortality and substantial sized portions of the forest die off. Large beetle kill areas would open up the forest canopy and create numerous snags and future coarse wood debris. Newly-created large open areas (previously densely canopied forests) as a result of beetle kill would reduce the potential goshawk nesting areas in the project area. Goshawk foraging habitat could experience some beneficial and some negative impacts from an increase in open areas depending upon the size, shape, juxtaposition, and proximity to other open areas. Generally, smaller openings would likely be more beneficial to goshawk habitat while larger openings of low canopy covered areas would be minimally useful to goshawks for foraging and of little to no value for nesting habitat. Nest trees for eagles and roosting trees for hoary bats could also become scarce should a beetle epidemic kill a large amount of trees. Much of the lodgepole stands are all of similar age and structure, making them susceptible to insect and disease. However, catastrophic events like these are impossible to predict and may not take place at all. Because this alternative would have no direct impacts on these species and large scale epidemics

are impossible to predict, the No Action Alternative would have “no impact” on the northern goshawk, bald eagle, and hoary bat.

In the absence of fire or habitat management, vegetation succession has been a major cause of habitat loss for bighorn sheep in Colorado (Wakelyn 1987). Forests likely would become denser and encroach on historically open spaces, degrading visibility and decreasing foraging habitat for bighorns. Because the continuation of fire suppression and lack of habitat management in bighorn habitat leads to the degradation of the quality and quantity of habitat, the No Action Alternative “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” for bighorn sheep.

Spruce-Fir Species – American marten, Boreal owl, Pygmy shrew, Olive-sided flycatcher

There would be no direct impacts to any of these species under the No Action Alternative. Spruce-fir forest would continue to age, possibly increasing the quality of habitat for these species. There could be some indirect impacts to them in the long-term if there should be large forest die offs due to beetle infestations and large scale fires that may occur. This could cause a loss of foraging and nesting/denning habitat for these species if large areas of forest cover should be lost due to beetle kill or fires that could occur. However, these types of events may or may not occur and are impossible to predict if and when they would occur. There would be “no impacts” to the American marten, boreal owl, pygmy shrew, or olive-side flycatcher for the No Action Alternative.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 1 (PROPOSED ACTION)

Riparian Habitat Species – Boreal Toad, Northern Leopard Frog, and River Otter

Though amphibians and river otter are closely associated with riparian areas, they also do rely upon upland forested areas for portions of their life cycles (overwintering for toads, traveling for otters). In general, no treatments would be allowed in the water influence zone and these riparian areas, including kettle holes. There is approximately 1,220 acres of mapped riparian habitat within the project area. As the riparian areas themselves would be buffered from treatment, adjacent forested areas sometimes used by these species could be impacted. Fuels reduction (thinning and prescribed burning) treatments, if they are not too widespread or intensive may improve suitability of potential breeding areas by increasing prey habitat for toads and northern leopard frogs in the adjacent forest stands by stimulating early seral conditions (Pilliod 2006). If partial harvest treatments are done to lighter intensities, they can produce a combination of positive and weaker negative responses than intensive or clearcut treatments (Semlitsch 2009). Their study disclosed that clearcuts and intensive canopy removal had detrimental effects of canopy removal, higher surface temperatures, and loss of soil-litter moisture in terrestrial habitats surrounding breeding ponds and mitigating these effects is critical to maintaining viable amphibian populations in managed forested landscapes. According to Smith and Keinath (2007), most amphibians do not use habitat in recently clearcut areas or severely thinned areas, and there is a general association of stand age and abundance of them, with toads and frogs more common in older stands. Project activities such as thinning, patch cutting, salvaging, yarding/skidding, and prescribed burning can all impact sub-adult and adult toad and frog upland travel and foraging areas due to habitat conversion and fragmentation (e.g., loss of vegetative ground cover, litter, and large woody material that are used as microclimatic habitat sites). Consequently, this could have some negative impacts on amphibian population parameters such as productivity and survival. Areas thinned in the project area would be done in an uneven age

management style with reserves interspersed throughout the project area. According to the *Boreal toad Conservation Plan and Agreement* (2001), uneven age stand management is the preferred method of tree removal in boreal toad habitat. This practice results in fewer disturbances to the understory and ground. There are no known boreal toad or northern leopard frog breeding sites within the project area, though suitable habitat is present. Should a breeding site be discovered during the course of this project and implementation, these sites would be buffered by no treatment boundaries.

River otters are highly mobile and readily disperse along waterways and they are able to move between drainages by crossing high ridges or even mountain passes (Melquist 1983). Melquist also reports that river otters generally avoid areas where cover is lacking, such as reservoir shorelines with little vegetation or structural cover, even if food is abundant. Timber harvest can reduce riparian cover, increase stream siltation, and reduce woody debris that provides important cover.

In general, no treatments would be allowed in the water influence zone and these riparian areas would be buffered. Exceptions to this would be the stream restoration proposals for Halfmoon Creek where natural river restoration techniques would be utilized to improve sediment transport and aquatic habitat. Fish friendly culverts or aquatic organism passageways would be installed to return native flow back to creeks and promote movement of aquatic species. The installation of nesting platforms would likely be very near the shoreline at Turquoise Lake. To protect and improve riparian ecosystems, non-system routes and dispersed campsites that are near or go through riparian areas may be closed.

There could be some short-term (0 – 10 years) negative effects during the implementation of these riparian restoration proposals mentioned here including increased sedimentation during implementation and human and noise disturbance. Highly mobile river otters could disperse upstream or downstream of the disturbance, whereas frogs and toads may or may not depending on their life cycle (eggs, tadpoles, adults) at the time of disturbance. The amount of sedimentation created would be dependent upon the stream size, flow, soil disturbance, and weather patterns. All activities proposed to take place within the water influence zone are designed to restore low functioning habitats to benefit the addressed species here as well as other fish and aquatic species in the long-term (10+ years).

Given the low probability of boreal toads, northern leopard frogs, or river otter in the project area and the small likelihood of direct impacts to them from the proposed activities, there is not a concern that the proposed action would result in a trend in federal listing or a loss of its viability rangewide. Regardless, management activities in suitable/potential amphibian and otter habitat should maintain suitable habitat conditions for them to re-colonize historical areas that may be unoccupied at the present time. Based on the rationale here Alternative 1 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” of the boreal toad, northern leopard frog, or river otter.

Sagebrush Species – Brewer’s Sparrow

Brewer’s sparrows are sagebrush obligates and only a minute amount (about 20 acres) of the project area is classified as sagebrush. Habitat loss and fragmentation seem to be the biggest threat to Brewer’s sparrow as large areas of sagebrush are essential for breeding (Holmes 2005). Human development adjacent to public lands often takes place in these lower elevations where sagebrush

may be fragmented and destroyed. The proposed project targets removal of encroaching conifers with limited additional access needed within this species' habitat. This would maintain and enhance the small amount of sagebrush habitat in the project area, thus benefitting this species in the long-term by maintaining sagebrush communities into the future. There would be some short-term impacts from noise disturbances during operations that would cause minimal short-term disruption in their activities and displacement may occur within and adjacent to treatment areas.



Conifer encroachment into sagebrush. Conifer trees in the foreground would be removed to improve sagebrush-dependent species habitat. Photo by J. Windorski.

Other activities associated with the proposed action would not take place in sagebrush communities and therefore would have no impact on Brewer's sparrow or their habitats. Because of the reasons stated here in addition to the cumulative effects discussed, Alternative 1 "may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing" for the Brewer's sparrow.

Aspen and Douglas fir habitats – Flammulated Owl

The proposed action could have negative impacts to flammulated owl from human disturbance during implementation, loss of habitat due to vegetation removal, and changes in nesting and foraging habitat qualities. However, one of the objectives of the proposed action is to create more species diversity. Douglas-fir would not be targeted for harvest and would be retained and encouraged to grow by cutting out competing lodgepole pines. Approximately 120 acres of aspen are proposed for treatment out of the 455 acres available in the project area. Aspen treatments are designed to promote aspen growth by removing encroaching conifer species and cutting the outer edges of stands to promote sucker growth and aspen regeneration. Habitat quantity and quality for flammulated owls is low-moderate within the project area. Treatments would retain and encourage regeneration of aspen which provide nesting opportunities for the owl. The proposed activities could cause disturbances due to the presence of personnel, machinery, smoke, and noise. The biggest impacts to these species would be the removal of snags, coarse wood debris, and canopy

cover. The proposed treatments would reduce the density of conifer stands. A more open stand structure could be beneficial for flammulated owl foraging as long as remaining habitat requirements are still met. Some opening up of the forest in places would likely cause an increase in shrub and dense foliage development, which could provide better foraging (increased insect densities) and roosting (brush and dense foliage) opportunities (Kingery 1998).

The proposed action would assist in creating a mosaic of habitat types and structures within the project area. Flammulated owls are secondary cavity nesters and rely on snags for perching, singing, and/or nesting in. The design criteria ensure that a minimum average snags per acre is retained in every treatment unit. Suppressing naturally-frequent ground fires in forests has allowed many stands to become dense thickets that physically limit foraging movements of flammulated owls (R. T. Reynolds 1998). The thickets also reduce the abundance of available arthropods by preventing the development of grassy and herbaceous understories. Patch cuts in and near aspen stands would open up the understory increasing grass and forb growth, thereby increasing foraging opportunities for flammulated owls. Wildfires are expected to increase in both number and intensity with large stand replacing fires becoming more likely than in the past due to increased fuel accumulations and the increased prevalence of stand structural homogeneity in forests on a landscape scale with fewer natural openings or firebreaks present. Prescribed burns proposed here would also have the same effect as patch cuts of temporarily opening up the forest floor and increasing grass production. Small fires are beneficial to all species analyzed as a whole in that they increase the diversity of the area and optimal habitat for each species is renewed. Individual animals may be negatively impacted if their home range is burned, but surrounding habitats would provide for local population sustainability. The short term (0 – 30 years) benefits to flammulated owls would include increasing foraging habitats by opening up some portions of aspen stands. The long term (30+ years) effects of patch cutting, thinning and clear cutting would include increasing horizontal diversity which could make foraging more difficult.

The other proposed activities would not take place in flammulated owl habitat. These additional activities would not have any direct impacts to flammulated owl or their habitats. The design criteria ensures that if a nesting flammulated owl was found inside the project area, that seasonal restrictions and appropriate buffer zones would be implemented. Overall, the proposed activities would have both negative and beneficial impacts to flammulated owls. Based on the rationale above and the fact that there is adequate, higher quality (old growth ponderosa pine) habitat available elsewhere on the district and forest, Alternative 1 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” of the flammulated owl.

Lodgepole Pine Habitat Species – Northern Goshawk, Bald Eagle, Hoary Bat, and Rocky Mountain Bighorn Sheep

Proposed activities would occur in goshawk, hoary bat, bighorn sheep, and bald eagle habitat as part of the proposed project (both in lodgepole and aspen). Up to 9,450 acres of lodgepole and 455 acres of aspen could be treated. However, not all of these acres are suitable for the species discussed here. Goshawks, bald eagles, and hoary bats tend to use larger diameter trees in older forest stands. There are no modeled habitat maps available for any of these species, but the acres of impacted suitable habitat are less than the acres identified for treatment. Conversely, bighorn sheep habitat has been modeled and mapped by Colorado Parks and Wildlife (Colorado Parks and Wildlife 2013), and there are approximately 500 acres of bighorn sheep habitat inside the project area in

treatable areas, with approximately 230 acres of that being winter range. The activities could cause disturbances due to the presence of personnel, machinery, smoke, and noise. Human disturbance associated with forest management and other activities may affect goshawks and can cause nest failure, especially during incubation (Kennedy 2003). However, other research in Kennedy (2003) reported that “disturbance generally does not appear to be a significant factor effecting the long-term survival of any North American goshawk population.”

“Forest management can impact the structure, function and quality of nesting and foraging habitat by removing entire nest stands, and removing canopy and mature trees, snags, and downed woody material. Forest management practices, such as controlled fire and thinning, may improve habitat for goshawks by opening up dense understory vegetation, creating snags, downed logs, woody debris, and other conditions that may benefit goshawks and their prey. One study suggested that goshawks can tolerate some levels of timber harvesting within the nesting stand (if no harvest is conducted between February and August) as long as cover reduction does not exceed 30 percent” (Kennedy 2003).

According to studies identified in Kennedy (2003), goshawks have been documented to forage away from forest cover in naturally-open habitats if available. Many of the treatment areas of the proposed project do not currently have dense understory vegetation. Complete removal of understory would likely reduce goshawk and eagle prey habitat for small- to mid-sized mammals and birds. Consequently, patchcut areas (0 – 5 acres) as well as clear cuts (up to 40 acres) would cause a reduction in habitat for prey species in the short-term (0 – 5 years) and could cause an increase in prey habitat in the mid-term (5 – 20 years) as small mammals and birds begin to utilize the re-growth of vegetation in these areas. However, if the openings fill in with dense regeneration, as is expected, goshawk foraging opportunities would become limited due to goshawks’ inability to exploit prey animals in densely stocked regeneration stands since goshawks primarily pursue their prey by chasing them down aerially.

Treatments may reduce the quality of habitat (both nesting and foraging) in some areas over the short-term (0 – 10 years). However, the quality of goshawk habitat is expected to increase in the long term (10 + years) by increasing vegetative diversity (i.e., increase the structural stages and species composition present in the project area) and maintaining a mosaic of structural stages across the landscape (Reynolds 1992). Small prescribed fires are beneficial to all species analyzed as a whole in that they increase the diversity of the area and optimal habitat for each species is renewed. Individual animals may be negatively impacted if their home range is burned, but surrounding habitats would provide for local population sustainability.

Closing and rehabilitating dispersed campsites would have a beneficial impact to nesting northern goshawks. Areas around the Turquoise Lake northern goshawk territory currently receive high volumes of dispersed recreation and camping near the nest sites. Removing old campfire rings, rehabilitating the soils and enforcing the “no camping” restriction in these areas would provide a more secluded area to nest without human disturbance. The addition of a nesting platform could have beneficial impacts to bald eagle should they find the area suitable for nesting.

Design criteria are in place to protect nest trees, adjust timing of treatment to avoid nesting season, and create protective buffer areas if goshawks and/or bald eagles are detected in the project area during future surveys or during project implementation. While the impacts to goshawk habitat from the proposed project may be detectable and noticeable for the short- to mid-term (0 – 15 years) and

may cause some negative impacts to individual animals, it is not likely to cause substantial impacts to them at the planning level. There should be long-term beneficial impacts to goshawk habitat due to the promotion of age class and stand structural diversity.

It is unlikely that the larger trees along the lake shoreline that may be suitable for bald eagle nesting would be removed as a result of this proposed action. The south side of the lake is too steep to safely treat and eastern edge consists of campgrounds, boat ramps, and day use areas, and is likely too heavily populated with recreationists to be a desirable place to nest for a bald eagle. It is unlikely that bald eagles would nest in this area as the lake is usually frozen into May or June, prohibiting any foraging for fish (the main species in their diet) during critical breeding and incubating periods.

Hoary bats are habitat generalists and are solitary bats, only congregating during migration. Clear cutting patches of forest would directly affect the hoary bat should it be utilizing any of those trees for roosting. This would cause an overall loss of habitat for this species until these trees return to sizes large enough to be suitable again for roosting. Thinned areas would still provide suitable roosting habitats and primary prey species (moths) should not be impacted as riparian areas (where moths are likely to be found) would remain buffered. Hoary bats are extremely mobile and would easily disperse to adjacent forested stands during project implementation. If they are present inside the project area, they are likely in low numbers and could disperse to any other forested stand for its roosting needs.

Treatments in bighorn sheep habitat could increase the effectiveness of the habitat by opening up the landscape and increasing the visual field of bighorns. Openings would also create more foraging habitat in the short term. Most mapped bighorn range is near the tree line, or in already open cliffy areas. These places are not likely to see much treatment as spruce-fir (which is not targeted for treatment) is generally the habitat type near tree line and open cliffy areas may not need treatment. However, the winter range located in the northern portion of the project area, does contain lodgepole pine and could be opened up with clear cuts or thinning. This would benefit the sheep as they travel through these areas to the natural mineral lick (a private gravel pit) that is drawing them into the area by increasing their visual field, further protecting them from predators. Reintroducing fire through prescribed burns in this area would also provide this benefit. However, the main travel corridor to and from this natural mineral lick is outside of the project area so this project may or may not directly influence the usage of the area. Design criteria are in place to ensure the protection of wintering bighorn sheep by restricting activities during the winter seasons. Short term impacts due to project implementation could be beneficial to bighorn sheep. Long term impacts as the openings and thinned areas regenerated to more dense stands may decrease the visual quality of those treated areas. This project would not increase the chances of bighorns coming into contact with domestic sheep (causing disease transmission), a main cause of decline in sheep populations.

The proposed action would add to the effects discussed in the cumulative effects section. Based on this rationale, Alternative 1 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” of the northern goshawk, hoary bat, bald eagle, and bighorn sheep.

Spruce-Fir Species – American marten, Boreal owl, Pygmy shrew, Olive-sided flycatcher

No green tree treatments are proposed in spruce-fir habitats outside of Ski Cooper. There are about 300 acres of spruce-fir inside the Ski Cooper boundary where green tree harvest would consist of

group and individual tree selection and treatments would be designed to develop multi-aged, multi-storied stands. There are no modeled habitat maps available for these species but we assume that some of these 300 acres would be suitable, while others may not be. Treatments within the ski area would be designed to develop multi-aged, multi-storied stands. Treatment would be minor as the ski area would not want major vegetation treatments to alter the integrity or visual quality of the family-oriented ski hill. The purpose of the treatment proposed here is to be able to create some age and species class diversity within the ski area and to prevent widespread mortality if spruce beetle should arrive at epidemic proportions in the future. Stands with greater than 35 percent dense horizontal cover would be retained for quality lynx habitat and would also provide refuge for the species addressed here. Snags may or may not be left on the landscape depending on the hazard level associated with each. Though Ski Cooper is a small ski area, the habitat quality and effectiveness has already somewhat been compromised, especially during the winter months, due to human disturbance, noise, fragmented habitat, snow compaction from skiers, snowmobiles and grooming operations, and displacement associated with maintaining a ski area. Summertime activities continue as well with maintenance and project completion of various levels done by the ski area employees themselves. The implementation of group and individual tree selection within the ski area boundary is not likely to have substantial impacts beyond what is already occurring there for the species addressed in this section.

Outside of the ski area boundary, where spruce-fir trees are present in mixed conifer stands, they would be retained and encouraged to grow by cutting out competing lodgepole pine. This could encourage regeneration of spruce-fir as well as add growth and vigor to existing mature trees and would have insignificant, if not beneficial, impacts to the species addressed here. It should be noted that all of these species could use lodgepole pine habitats as well and could be affected by project implementation on surrounding or adjacent lodgepole pine forests. In these areas, loss of habitat, habitat effectiveness, habitat fragmentation, and disturbance caused by project implementation could cause negative impacts to the species addressed under this section.

The proposed action also takes into account the possibility of a future (within the next 10 years) spruce beetle outbreak. There is a concern that the spruce beetle epidemic currently running its course approximately 80 – 100 miles south of the project area may make its way to this area. Should spruce beetle trigger a major die-off in spruce-fir, then up to 1,400 acres (out of 1,550 acres of spruce-fir mapped within the project area) of dead or infected green trees could be salvaged. The remaining 150 acres would be left on the landscape in patches greater than 5 acres namely for lynx denning habitat. Leaving large snag patches would provide habitat for the olive-sided flycatcher as well.

During salvage harvest operations, minimum snag requirements would remain in place. Most likely there would be additional snags created due to beetle die off that would be retained post project implementation that would provide additional nesting/perching habitat for boreal owls and olive-sided flycatcher. The maximum acreage of spruce-fir habitat that could be treated is 1,400 acres as a salvage harvest, though realistically, this number would likely be less due to access, slope, or other unforeseen reasons. Harvest practices may reduce primary prey populations, remove forest structure used for foraging, and eliminate nesting cavities for boreal owl (Hayward 1993). Some slash piles created during harvesting activities would be retained for small mammal habitat. The project thinning objectives are based on uneven age management which would provide for owl foraging habitat and permit timber harvest. "The association of American martens with structurally complex forests is related to their needs for avoiding their own predators, accessing prey beneath

the snow, and finding protected microenvironments for resting in winter and giving birth and sheltering neonates” (Buskirk 2002). Therefore, one could assume that any harvest treatments that remove structurally-complex stands from the landscape would negatively impact the marten. Martens are highly associated with moist site tree species like spruce-fir and would not likely be substantially impacted by harvest treatments in lodgepole pine forests. Salvage harvests in spruce-fir would create large openings that American marten would likely not cross and would remove any structural diversity associated with that stand.

Olive-sided flycatchers are most often associated with forest edges and openings caused by natural or anthropogenic disturbances, including small forest gaps resulting from tree death in old-growth forests, or along the edges of early successional forests. This project could create additional quality habitat for the olive-sided flycatcher. Abundant habitat is available in close proximity of this project (much of the project is adjacent to vast wilderness areas consisting largely of spruce-fir habitats) and all of these species are highly mobile, with the exception of the pygmy shrew, which may not as readily disperse.

The pygmy shrew is highly associated with “wet forests” and if present, is likely found in areas that would be avoided due to design criteria that restricts any treatment from taking place within 100 feet of the water influence zone. Salvage harvest would reduce snags for perching/foraging opportunities within the project area for boreal owl and olive-sided flycatcher. There would be some short-term impacts from noise disturbances during operations that would cause disruption in their activities and displacement may occur within and adjacent to treatment areas for all species addressed here. Salvage operations would cause loss of habitat for boreal owl, olive-side flycatcher, and American marten and would cause negative effects as all of these species would potentially use beetle killed stands for some portion of their habitat requirements.

Habitat inside Ski Cooper has already been degraded to varying degrees due to anthropogenic disturbances, snow compaction, and habitat fragmentation (cleared ski runs). The small amount of treatment inside the ski area boundary is not likely to have substantial impacts to the species addressed here beyond what is already occurring currently. Salvage harvest operations, should they take place, would cause habitat fragmentation, loss of habitat, and disturbance from project implementation. There would be no broadcast burning in spruce-fir habitat though pile burning could take place should the need arise. Design criteria are in place to preserve high quality habitats, snags, nest trees, and denning sites that would attempt to minimize the impacts to these species. The other projects proposed besides the vegetation treatment and prescribed burning would likely have immeasurable effects on these species as those projects are concentrated in a very small area for each project and would not have additional impacts beyond those that have already been discussed for vegetation management and prescribed burning. Alternative 1 “may adversely impact individuals, but not likely to result in a loss of viability on the planning area, nor cause a tend to federally listing” of the American marten, boreal owl, olive-sided flycatcher, or pygmy shrew.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 2

Riparian Habitat Species – Boreal Toad, Northern Leopard Frog, and River Otter

Since Alternative 2 is identical to Alternative 1 for the actions that would influence riparian areas, the effects would be the same for these activities. The differences between the two alternatives are in the percentages of tree harvest designated as clear cuts versus thinning treatments. This

alternative would likely have a higher degree of negative effects due to the impacts of more clear cutting. This would cause more canopy removal, higher surface temperatures, and loss of soil-litter moisture in terrestrial habitats surrounding breeding ponds. The effects of Alternative 2 timber harvest would be more exaggerated. Alternative 2 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” of the boreal toad, northern leopard frog, or river otter.

Sagebrush Species – Brewer’s Sparrow

The proposed activities for Alternative 2 differs from Alternative 1 only in percentages and acres of lodgepole pine and aspen treated. The proposed treatments within sagebrush communities remains the same and would have the same impacts as discussed above for Alternative 1. All other proposed activities would also remain the same and would not take place in Brewer’s sparrow habitat. The impacts would be the same and Alternative 2 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” for the Brewer’s sparrow.

Aspen and Douglas-fir habitats – Flammulated Owl

This alternative is very similar to Alternative 1 other than there are fewer total acres being treated but a larger percentage of those are in clear cuts. The amount of aspen treated in Alternative 2 is slightly more than that proposed in Alternative 1. The additional 65 acres of aspen treatment is likely to have insignificant effects overall to flammulated owl. All other actions would have the same effects as in Alternative 1. The effects of Alternative 2 would be nearly identical to those identified in the previous alternative. Based on this rational, Alternative 2 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” of the flammulated owl.

Lodgepole Pine Habitat Species – Northern Goshawk, Bald Eagle, Hoary Bat, and Rocky Mountain Bighorn Sheep

Alternative 2 would have similar effects/impacts to goshawks and bald eagles as Alternative 1, but at a larger scale due to the increased acreages being clear cut under this proposal. However, the overall acreage treated and the disturbance associated with implementation over a smaller area would be less. A larger percentage of openings would likely have more of a negative impact on northern goshawk nesting habitats but could increase foraging opportunities as grass and forb production would increase, in turn, increasing prey species availability. The same design criteria mentioned above would remain in place to protect any historic, current, or future northern goshawk or bald eagle nesting territory. The negative effects associated with habitat loss for hoary bats in clear cut areas would be to a greater degree for this alternative as more acres would be temporarily lost. Bighorn sheep would see a greater short term benefit from this alternative but could have more adverse effects long term as denser stands regenerate in these openings, inhibiting the visual field of bighorns. Based on this rational, Alternative 2 “may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing” of the northern goshawk, hoary bat, bald eagle, and bighorn sheep.

Spruce-Fir Species – American marten, Boreal owl, Pygmy shrew, Olive-sided flycatcher

This alternative would have similar effects on the species addressed in this section because the proposal within the primary habitat (spruce-fir) of these species remains the same as that in Alternative 1. There would be larger negative effects should these species be utilizing lodgepole pine forests as there would be more clear cut areas but fewer acres treated overall. The impacts associated with the other actions in this alternative are concentrated in a very small area for each project and would not have substantial additional impacts beyond those that have already been discussed for vegetation management and prescribed burning. Based on this rationale, Alternative 2 “may adversely impact individuals, but not likely to result in a loss of viability on the planning area, or cause a trend to federally listing” of the American marten, boreal owl, olive-sided flycatcher, or pygmy shrew.

MANAGEMENT INDICATOR SPECIES**DIRECT AND INDIRECT EFFECTS – NO ACTION**Rocky Mountain Elk

There would be no direct effects to elk for the No Action Alternative as there would be no human disturbance or direct vegetation manipulation. Forests would continue to grow and create more closed canopy stands and remain susceptible to large scale disturbances due to the monoculture of lodgepole pine that currently dominates the landscape. Natural succession would create new pockets of openings during endemic beetle events providing opportunities for new grasses and forbs to replace the trees during the short-term (0 – 15 years). Should a large-scale beetle breakout occur, large areas of trees could die leaving an over-abundance of new forage for elk, at the expense of losing hiding cover. However, these large scale events are impossible to predict as to when or if they would ever occur. Because elk are capable of utilizing a variety of habitats, it is likely that the populations would continue to thrive even in the face of current levels of recreation, ongoing timber harvest, and other disturbances mentioned in the cumulative effects section. Because of these reasons, the No Action Alternative would have “no impact” on elk population trend or viability on the forest.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 1 (PROPOSED ACTION)Rocky Mountain Elk

This project area includes designated winter range and production area range for elk. These designations indicate that foraging and cover are substantial factors within these areas throughout the winter months and during calf-rearing. The quality of hiding and thermal cover within the project area is somewhat diminished in areas because lodgepole pine tends to “prune” itself as it grows, leaving fewer needles and branches to provide that cover. Currently many areas inside the project do not provide quality cover as there is little regeneration or growth in the understory that provides high quality, horizontal hiding cover. Stands that do provide high quality cover would be retained as described in the proposed action above which coincides with habitat protection for Canada lynx. Thinning, clear-cutting and prescribed fire would stimulate regeneration and would provide better quality thermal and hiding cover in the mid- to long-term (15+ years) than currently exists in some areas of the project. In the short term (0 – 15 years), grasses and forbs would increase as the canopy would be opened up allowing more light to penetrate the forest floor, providing

higher quality foraging for elk. Before this vegetation redevelops, females and their calves could move into other available habitat adjacent to the project area for calving and all elk could disperse to adjacent areas available during the winter.

Migration of large ungulates in this region is triggered by snow depths which deem forage inaccessible. During the winter, clear cuts, heavily thinned areas and temporary roads (depending on roadside cover) would accumulate deeper levels of snow compared to the treed stands in the same area. This could cause additional energetic costs during winter for big game to traverse through these areas or cause a change in movement patterns as animals avoided the clear cut by traversing around during seasonal migration. Conversely, these same clear cut areas would also melt faster than treed areas providing earlier foraging and easier travel through these areas in spring when fat reserves and body conditions are usually suboptimal. Openings are designed to augment current natural openings (meadows already on the landscape) and mimic natural disturbance regimes and would not be larger than 40 acres. Clear cuts would likely be located in or near elk migration corridors (lower elevation lodgepole pine) as mapped (Colorado Parks and Wildlife 2013) in order to address the purpose and need of this project.

During implementation, elk would likely avoid using the project area as disturbance would be increased due to noise, people, and machinery. Again, implementation would be spread out over the course of 10 years throughout the project area. Prescribed fire would bring an additional temporary increase in disturbance due to smoke for several days afterward, deterring elk from using the immediate area. There is habitat available adjacent to the project area in which elk could seek refuge during the time this project is implemented. Disturbance to the ground may provide the opportunity for noxious weeds to invade the native vegetation, thus discouraging foraging by elk within the project area. However, the proposed action addresses noxious weeds and would incorporate treating pre and post treatment to discourage non-native vegetation from spreading. Other actions associated with this proposal would have negligible impacts as the footprint of those actions are minute in relation to an elk's home range and these animals would be able to easily disperse to adjacent habitat during project implementation.

Thinning, prescribed burning, and regeneration treatments would likely increase forage production and would be beneficial to elk. Alternative 1 would likely increase quality foraging opportunities as well as decrease important hiding cover for elk in the short term (0 – 15 years). However, the long-term effects would shift and hiding and thermal cover would increase as regenerating trees develop and take over the grass and forbs that initially provided new foraging areas. Again, the implementation of this project would take 10 years and the treatments are spread out over a very large area, never impacting one isolated area to a degree in which elk would not utilize some portion of the treated area. Overall, implementation of Alternative 1 is expected to have “no effect on elk population trend or viability on the PSICC.”

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 2

Rocky Mountain Elk

This alternative is very similar to the proposed action in treatment proposals except that it is smaller in overall size. All other activities proposed would remain the same and would have identical effects as in Alternative 1. The type of disturbances (machinery, noise, human disturbance, vegetation removal) would have the same effects (dispersal, avoidance, decreased cover and increased

foraging) but to different degrees. There would be a larger initial increase in foraging as there would be more openings created and less loss of hiding and thermal cover due to fewer acres being treated overall. Again the mid- to long-term (20+ years) effects would then reverse as the regenerating trees would provide quality hiding and thermal cover as they repopulated the clear cuts that once provided the foraging opportunities. Though the effects may be greater for this action alternative due to the higher degree of clear cutting, implementation of Alternative 2 is expected to have “no effect on elk population trend or viability on the PSICC.”

MIGRATORY BIRD TREATY ACT

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES

This project could impact migratory birds directly, indirectly, and cumulatively through habitat loss, fragmentation, and loss of habitat effectiveness. Some short-term effects to migratory birds include: disturbance from machine noise, people, vehicle traffic, smoke from prescribed burns, and changes in nesting and foraging habitat. However these bird species are highly mobile and would be able to disperse easily to adjacent suitable habitat should they be in the area during implementation. Depending on species, treatments could be beneficial to nesting and foraging habitat as well (i.e. species that prefer more open understories for foraging could benefit). The Tennessee Creek Project includes multiple design criteria that apply to TES and/or migratory bird species. Because of these design criteria, implementation of this project may have some short-term adverse impacts to individuals, but no long-term impacts to migratory bird populations.

CUMULATIVE EFFECTS

FOREST SERVICE SENSITIVE SPECIES AND MANAGEMENT INDICATOR SPECIES – ALL WILDLIFE SPECIES ADDRESSED

The following is a general discussion of the cumulative effects from these activities and is pertinent to all species addressed. See additional cumulative effects in *Threatened, Endangered, and Forest Service Sensitive Species on the Pike and San Isabel National Forests* (Wrigley 2012) for additional information.

Below is a summary of future federal and non-federal (private, state, or tribal) activities that are reasonably likely to occur within the analysis area that directly and indirectly affect species addressed. In many instances, those past activities and their effects remain to this day and are currently ongoing as well.

- Mining (on non-federal/federal lands) can cause destruction of habitat, leaching of heavy metals in to streams changing stream pH, erosion, and sedimentation into streams. Some smaller (less than 5 acres) active mining claims are within the analysis area. For the most part, future mining activities are expected to be much less common and at a smaller-scale than has occurred historically. These activities have and will continue to affect wildlife species addressed here indirectly and cumulatively through fragmentation, habitat loss, degradation of habitat, and loss of effectiveness through human disturbance.
- Fire suppression (on non-federal/federal lands) has led to increased fuel loading, tree density, and canopy closure in some areas – particularly lower elevations where the fire-return interval is shorter than the longer intervals in high elevation forested ecosystems.

Few snags were created because of fire suppression and existing snags continued to be harvested for fuel. These historic activities combined to produce a forest that has smaller trees, less structure (snags and coarse woody debris), less species diversity, and a low stand age diversity (more mid-seral forests) that have directly and indirectly affected many of the wildlife species addressed here. Future suppression activities are expected resulting in a continuation of these effects. However, an increased amount of prescribed fire and use of natural fires is also expected in the future which would lessen the impacts stated above, benefiting many of the species that have evolved with fire as a major disturbance.

- On-going and future motorized and non-motorized recreational use (including OHV use, camping, horseback riding, mountain biking, hiking, hunting, and fishing) will continue to lead to the development of non-system roads and trails, development of dispersed campsites, erosion, disturbance to wildlife species, and the vectoring of invasive and noxious weeds and predators in previously pristine areas. Numerous activities require continued use of, and/or construction of new roads and trails on both federal and non-federal lands. New roads in particular increase soil erosion, sedimentation, fragmentation, directly remove habitat, and facilitate the spread of invasive and noxious weeds and predators (e.g., corvids). The spread of noxious weeds will continue to lead to changes in species composition of the Forest, increased competition with native plant species, and altered fire regimes that will adversely affect many plant and wildlife species addressed here. Each of these activities is expected to continue and increase in the future and will adversely impact wildlife species directly, indirectly, and cumulatively through fragmentation, habitat loss, degradation, and loss of effectiveness.
- The Forest and adjacent ownerships are an important resource providing for a wide variety of public recreational activities, which are expected to continue to increase in the future as the population of the region continues to grow (USDA Forest Service 1984). A substantial amount of public recreation currently occurs over the entire project area. Use by the general public in some areas of the District is substantial. An average of approximately 77 – 90 percent of the overall recreation use on the District is from public recreation in some important mountainous areas. The attractions of climbing “14er peaks” and high elevation lakes draw people to these scenic mountains. As populations in Colorado and the Front Range continue to grow, there will be increasing use of the backcountry for recreational activities, which will increasingly harass wildlife species and destroy their habitats. In areas of concentrated public recreation, effects from future public recreation will contribute to cumulative effects to each of the species addressed.

Other motorized use by the public, such as snowmobile use is unrestricted over the entire District (outside of Wilderness Areas). Snowmobile riders are only limited by their machines, terrain, and snow conditions. Public use during the winter is widespread over the District (depending on snow condition) and their use is currently not regulated by the Forest Service or restricted to designated snow compaction routes. This increases in orders of magnitude the impacts from snow compaction, noise disturbance, and numerous other impacts to habitat and species from these and other similar recreation activities. For example, general public recreation uses in several important high winter concentration areas is substantial – particularly in winter. General public use accounts from about 50 to 90 percent of the winter recreation within these areas. Given the existing and anticipated annual increase use in public use, these recreation activities occurring on the Forest may impact these species

addressed even further. Impacts from these activities to wildlife are increased considerably from this additive use.

Non-motorized activities by the general public occur frequently in roadless, remote backcountry locations (e.g., horseback, hiking, snowshoeing, skiing). In areas where general recreation use is low (e.g., backcountry), effects from public recreational activities may be of greater influence on these species due to habitat modification (e.g., snow compaction and ground disturbance), changes in wildlife species composition (increased predators), and noise disturbance to wildlife in remote areas. Outside of wilderness areas, motorized winter and summer use will also occur. As discussed above, recreation activities have influenced the travel system in the project area and this is expected to increase into the future.

Motorized OHV use is restricted to designated routes; however, compliance is not often achieved. Increased use of OHVs for recreational use has resulted in an extensive “user-created” network of travel routes. As these new routes become more established over time, they would eventually be viewed by the public as system routes. The continued creation of new roads/trails would decrease the habitat effectiveness and capability within the project area. Roaded areas would also receive heavier recreational use because of easier access.

Many of these types of recreation use can lead to habituation or harassment of animals, depending on the factors listed above in the previous section. Effects of recreation activities on these species vary and depend on the type of activity as well as the species affected. Not only does recreation have direct effects to these species, but also indirect effects on animal populations are likely to be substantial but there is little rigorous documentation on these impacts (Cole 1995).

“Recreational activities clearly have substantial and generally adverse influences on terrestrial vegetation and soil, and on aquatic systems. Since these provide living space, shelter, and food for wildlife, animals are affected by these changes. For vertebrates, amphibians, reptiles, small birds, small mammals, and many fish, these indirect effects are likely to be more substantial than direct impacts from recreationists” (Coloe 1995).

Each of the above activities will continue to increase in the future both on and off-Forest, incrementally causing substantial impacts to wildlife species addressed in this assessment directly, indirectly, and cumulatively through fragmentation, habitat loss, degradation, and loss of effectiveness through human disturbance. These activities are expected to increase and have even greater impacts in the future.

- The impact of invasive plants (noxious weeds) and animals (which can displace native/desirable wildlife species – e.g., cowbirds) on biodiversity is a major concern on all land ownerships in North America. Although the magnitude of the effects of non-native invasive plant and animal infestations specifically on these species’ habitat has not been fully understood, the potential exists for large-scale impacts and alteration of habitat. Invasive weeds such as diffuse and spotted knapweed (*Centaurea diffusa* and *C. maculosa*), leafy spurge (*Euphorbia esula*), rush skeletonweed (*Chondrilla juncea*), dalmation toadflax (*Linaria dalmatica*), Canada thistle (*Cirsium arvense*), cheatgrass (*Bromus tectorum*), and many others have the potential to alter habitats important to these species at both the local and ecosystem scale (Ruediger 2000). Many of these plants are more easily eradicated at

the level of a few plants or a few acres. Once established, they spread aggressively and become extremely difficult to control. Invasive species impact natural habitats, alter ecosystem processes such as nutrient cycles and fire regimes, and reduce biodiversity. Invasive species have and will continue to cause devastating effects directly on many wildlife species and their habitats. Actions could include efforts to prevent the establishment of new weed populations, controlling the spread of existing infestations, providing information to the public, and cooperating with other agencies and landowners in developing and implementing prevention and control programs. The Rocky Mountain Region Invasive Species Management Strategy (USDA Forest Service 2008) addresses the management, control, and treatment of weeds in order to minimize effects, although these plants and their effects will not be eliminated.

- Future non-federal and federal water development projects such as municipal water sources for surrounding towns and cities – particularly to satisfy the growing demand of the Front Range Region – are anticipated to impact these wildlife species and their habitats directly, indirectly, and cumulatively in the future through water depletion, fragmentation, and habitat loss. Additional ditching and draining will negatively impact wetlands throughout the western United States. Ditching and draining has been implemented for a variety of reasons, including creation or improvement of livestock pasture, conversion of wetlands or wet meadows for agriculture (particularly hay production), water diversion, mining, and peat mining. Ditching or draining alters water relations within the wetland, leading to numerous secondary effects such as species composition change, easier access to livestock, wildlife, and motorized vehicles, colonization by invasive plant species, and others. These activities are expected to increase in the future.
- Future timber harvest and thinning on both federal and non-federal lands will lead to a more open forest canopy with additional light reaching the forest floor affecting microhabitats, moisture, etc. (which may be beneficial or detrimental depending on the species), soil disturbance and compaction, development of skid roads, noxious weed invasion, and other effects. Changes in forest composition, structure and fire frequency have also taken place and will continue to do so with future projects. This may particularly be detrimental to species requiring denser forests with higher canopy cover, older-aged forests, high amounts of snags, logs/CWD, etc. although they may benefit those species preferring more open and younger-aged forests, shrublands, etc. These actions have and will continue to incrementally impact many wildlife species addressed here in the future directly, indirectly, and cumulatively through fragmentation, habitat loss, degradation, and loss of effectiveness through human disturbance. These activities have and will negatively affect to varying degrees these species and their habitats directly, indirectly, and cumulatively as discussed previously.
- Human development is expected to continue in the analysis area on private lands as well. The population in Lake County and surrounding counties within the analysis area is expected to continue to increase approximately 2 – 5 percent annually over the next 30 years (Colorado Department of Local Affairs 2013) which will further impact wildlife species and habitats. As more and more private lands adjacent to the Forest are developed, this could adversely affect many plant and wildlife species by the following: direct habitat loss, increased fragmentation, further isolate populations, increased frequency and intensity of human disturbance, increased recreational use from nearby residents, and increased risk of

weed invasion. In addition, housing units and human developments within wildland/urban interface areas immediately adjacent to the Forest substantially increase the risk of wildfires on the Forest that also will affect habitat for these species. This will cause direct and indirect adverse effects to wildlife and their habitats through direct and indirect habitat loss and degradation.

- While climate fluctuates naturally, it is widely accepted that weather patterns (temperature and precipitation) in the western United States is changing substantially and these changes will continue to affect wildlife distributions and habitats. For example, riparian areas have been, and will increasingly be impacted as a result of decreased water availability leading to lowered peak flows and a decrease in the area, intensity, and duration of wetted soils. Shifts and changes in wildlife habitats are expected to substantially affect wildlife and their habitats as a result of changes in temperature and precipitation. Vegetation dynamics, disturbance, and climate and their interactions are key elements in predicting the future condition of ecosystems and landscapes and the vulnerability of species and populations to climatic change. Climatic factors such as temperature, precipitation, and wind patterns are among the many factors that influence vegetative structure and composition, fire behavior and wildlife habitat. Changes in general climate trends in North America during the past 100 years include (Inkley 2004):
 - **Temperature**
 - Global surface temperatures increases
 - Increase in night-time low temperatures
 - Greater warming on land than on water
 - Greater warming at higher temperatures
 - Fewer days of extreme low temperatures
 - More days of extreme high temperatures
 - Greater warming in winter than in summer
 - **Precipitation**
 - Increased frequency of precipitation events
 - Increased intensity of extreme precipitation events
 - More areas with increased precipitation than decreased
 - **Other climate factors**
 - Increased cloud cover
 - Sea level rise
 - Reduced snow cover
 - Receding glaciers
 - Thinner and less areal coverage of Arctic sea ice.

Other indirect effects of climate change may have beneficial or detrimental effects on many of the species addressed here. A recent study of the effect of climatic change on wildfire in the western U.S. (McKenzie 2004) determined that with warming climate, fire seasons will likely be extended and that total area burned is likely to increase. As a result, substantial changes in the distribution and abundance of dominant plant species in some ecosystems may occur. Some species that are sensitive to fire may decline, whereas the distribution and abundance of species favored by fire may be enhanced. For example, stand replacing fires are a common occurrence throughout much of lynx habitat and often provide conditions conducive to producing good quality snowshoe hare habitat.

The complexities of climate change described above are likely to affect wildlife and ecosystems in equally complex ways, and vary tremendously. For example, increased nighttime temperatures could markedly influence the range patterns of species with life histories especially influenced by ice or snow cover, or other species that require certain minimum temperatures to induce physiological changes (seed germination for example). These same species could be largely unaffected by increased daytime temperatures however.

In response to projected climate changes in the next 100 years, the geographic ranges of North American flora and fauna (plants and animals) are expected to shift upwards in elevation and generally northward (IPCC 2002). Temperature, rainfall, soil moisture, and specific physiological requirements of each species addressed here are expected to be driving forces in these shifts. Range shifts of wildlife are likely to depend upon factors such as the availability of migration corridors, suitable habitats, and the concurrent movement of forage and prey species. Further complicating potential range shifts will be other landscape changes such as roads, cities and habitat fragmentation, all of which can present substantial barriers to species range shifts (Inkley 2004). These changes will have profound effects on wildlife, their habitats, and entire ecosystems.

In summary, there is incomplete or unavailable information upon which to base any more detailed analysis of climate change risk factors for many of the wildlife species addressed here. The best available information indicates that climate change poses potential risks, but the exact nature of these risks remains uncertain at this time.

MANAGEMENT INDICATOR SPECIES

Many activities that have occurred in the past, are ongoing or are reasonably anticipated add to the cumulative effects on elk in the project area. As mentioned above, mining has occurred within these Data Analysis Units since the late 1800's when miners harvested much of the conifers for mining timbers, fuelwood, and charcoal. These activities essentially left massive clear cuts across the land and mostly lodgepole pine and aspen were the only trees that regenerated. Fire suppression also added to the creation of homogenous dense stands as sapling survival increased without natural fires. Tree species diversity, structure and stand size were reduced, thereby degrading wildlife habitat. There have been numerous small scale timber projects within these DAUs ranging from clear-cut harvests to thinning. Public and commercial sales are ongoing and are projected to continue on a limited basis. These timber projects can impact elk both positively and negatively. Modifying habitat directly reduces thermal and hiding cover but also opens up the canopy, encouraging more favorable foraging growth.

Recreation has and continues to be popular within each DAU. This includes: OHV use, hiking, biking, horseback riding, camping, snowshoeing, skiing, snowmobiling, and various races. This amount of varied use often leads to the creation of non-system roads and trails that further impact wildlife by direct removal of habitat, fragmentation of habitat, and disturbance from people and noise associated with each activity. User created roads also increase soil erosion and the spread of noxious weeds which also degrades elk habitat by decreasing native vegetation. Urban development along private lands also impacts elk by degrading habitat, fragmenting, and increasing human disturbance.

All these activities have altered the present landscape to various degrees and have direct, indirect, and cumulative effects on elk. The proposed project could add to these effects on elk through disturbance due to project implementation, though user numbers would be expected to return to

pre-treatment levels after the project is completed. Hiding cover would be reduced by the removal of trees along the roadways, though self “pruned” lodgepole have decreased the quality of hiding cover in some areas. Other areas do provide adequate or quality cover and would be reduced in the short term (0 – 15 years) after implementation. The project area is within Colorado Parks and Wildlife mapped winter and production (calving) range (Colorado Parks and Wildlife 2013). These are areas where elk typically concentrate during the winter months and during their calf-rearing period. As mentioned above, project design criteria restrict operational periods during production and stressful winter seasons.

Cultural Resources

EXISTING CONDITION

The cultural resources located within the Tennessee Creek project area constitute a unique and important record of human habitation of the upper Arkansas River valley and for the overall history of Colorado. They are fragile and non-renewable resources. The significance of individual sites is a function of their relationships to important events, peoples or styles, and their ability to provide additional scientific information about the prehistory or history of the area.

To date, 55 historic properties (termed “prehistoric sites” or “historic sites”) have been identified and recorded. “Historic” refers to sites with materials and items common to European immigrant cultures of the Western Frontier, and the use of such sites usually dates after AD 1860 in the Pike and San Isabel National Forests. “Prehistoric” refers to sites with materials and items common to American Indian cultures of Colorado, and the use of these sites usually dates before AD 1860, and may be much earlier (even several thousand years ago). 41 of these properties are historic sites, 11 are linear sites, two are prehistoric sites, and one is a multi-component with both prehistoric and historic resources. Additionally, 45 resources were recorded as isolated find/ single use, small scale event locations. As a result of the previous inventories more than 100 historic properties were identified and recorded. These properties consisted of primarily historic sites but several prehistoric sites were also identified. From the over 100 properties recorded approximately 32 have been determined either eligible or potentially eligible for listing on the National Register of Historic Places and have been or will be re-evaluated.

The project area encompasses two large Historic Mining Districts that were large producers of silver in the late 19th century. These Districts were the Sugar Loaf Mining District located on the south side of Turquoise Lake and the St. Kevin Mining District on the north side of Turquoise Lake. The 2011 surveys focused on these two locations and the majority of the recorded properties provide scientific information on the activities that occurred in these mining districts. As far back as 1860, prospectors found placer then hard rock gold in the Leadville area and in the mid-1870’s silver and industrial metals were discovered. It was the discovery of silver that made Leadville and the Upper Arkansas River Valley famous throughout the mining world. Local flurries of activity were based on the discoveries of promising ore deposits and their exploration. These local boomlets were quite limited in a geographic sense; as one area “hit it rich,” there would be a short period of expansion and frenzied activity followed by a contraction as the lode played out and another strike was made somewhere else.

Mining sites in the project area are expressed as prospect complexes, mining complexes, transportation routes, miner’s cabins, charcoal processing areas, and mining camps. Identified

resources include: mining camps consisting of domestic refuse, tent platforms, foundations and construction material, and cabins; prospect complexes consisting of shallow explorations and some domestic refuse; trash scatters consisting of domestic refuse such as solder dot cans, ceramics, metal, leather, and colored glass; mining complexes consisting of developed shafts and adits and associated construction material; charcoal processing sites expressed as concentrations of charcoal, platforms, depressions, brick kilns, and associated refuse; clay borrow areas characterized by large depressions with clay soil along the edges of the pits; road and pack trail systems connecting the above mentioned resources and primarily associated with these sites.

Transportation related sites are also associated with the Colorado Mining Boom. Wagon roads and railroads were needed to transport settlers and supplies to the mining districts and to bring the ore out. One important transportation resource discovered during a previous investigation but never recorded is the Colorado Midland Railroad, now expressed as the abandoned grade and related phenomena such as cuts and fills, sidings, and railroad related refuse. The Midland Railroad is an outstanding resource in the context of the development of rail transportation from Colorado Springs to the Central Mountains of Colorado. This cultural property is an example of the pioneering spirit of Colorado and the west. The Midland Railroad went through the St. Kevin and Sugar Loaf Mining Districts along what is today Turquoise Lake by 1887, and then up and over Hagerman Pass. The other railroad within the project area is the Denver Rio Grande (D&RG) Railroad which had a line graded to Leadville by 1880. The D&RG built west from Leadville over Tennessee Pass in an attempt to reach the mining areas around Aspen, Colorado before its rival railroad in the area, the Colorado Midland, could build a line reaching there. The D&RG built a line through Glenwood Canyon to Glenwood Springs, reaching Aspen in October 1887. The D&RG then joined with the Colorado Midland to build a line from Glenwood Springs connecting with D&RG at Grand Junction. Originally considered a secondary branch route to Grand Junction, the entire route from Leadville to Grand Junction was upgraded to standard gauge in 1890, and the original narrow gauge route via Marshall Pass became a secondary route.

Several sites within the project area are associated with the 10th Mountain Division and their field training activities that took place within the project area during the 1940's. The 10th Mountain Division's base operation was located in Camp Hale from 1942 – 1945. They accomplished a variety of winter training activities at Camp Hale, Cooper Hill (now Ski Cooper), and the surrounding area. These field camp sites and training locations often contain cans from military rations, ammo boxes, and munitions.

Overall, the project area contains a rich supply of historic resources that are valuable sources of information on the late 19th and early 20th century mining booms that occurred in the Upper Arkansas River Valley, and the use of the north part of the Leadville Ranger District by the 10th Mountain Division in their field training exercise that made them so successful during WWII.

The prehistoric resources identified are valuable in understanding Native American use patterns of this region. The relatively small number of sites could indicate that this area was not heavily utilized by prehistoric Native American groups, or it could be a result of the wide spread mining and logging operations that destroyed the surface expression and thus the immediate observable archeological record. The two sites identified are characterized as surface areas of stone tools and stone tool manufacturing debris. Prehistoric sites with relatively few surface items and with no recognizable material concentrations are usually interpreted as resource procurement and processing areas; sites with relatively many surface items (30 or more) and material concentrations are thought to be

seasonal camps. The prehistoric properties represented within the Tennessee Creek project area probably represent locations where small prehistoric social groups processed and consumed harvested resources and carried out lithic reduction activities. The prehistoric resources appear to date from the Late Prehistoric period (A.D.100-1725). The area was probably inhabited during earlier periods, but the evidence for such use has been obscured or destroyed by later human use and geological forces.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

The No Action Alternative would have little to no effect on cultural resources within the project area. Under the No Action Alternative, current management plans would continue to guide and implement actions within the project area. No vegetation management or fuel reduction activities would be implemented to accomplish the project purpose and need. This alternative would have no immediate, direct effects on cultural resources.

The No Action Alternative would have the indirect effect of maintaining the current level of hazardous fuels in the areas surrounding the known cultural resources within the project area. Large fuel loads and the increased potential for a catastrophic wildfire are a real threat to cultural resources, especially from high severity fires. If no action is taken to reduce these risks, cultural resources are vulnerable to modification or destruction.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 1 (PROPOSED ACTION)

Primary impacts to cultural resources from the use of mechanized equipment for thinning may include the displacement, alteration, and destruction of surface artifacts and cultural features, as well as disturbance to site soil deposition and site stability. In addition, architectural components such as standing wooden or stone structures may be knocked down by machinery. Primary impacts to cultural resources from thinning could include disturbance of cultural resources within OHV or vehicle access routes and damage to architectural components during cutting. Road improvement and/or deconstruction may disturb subsurface cultural deposits. In addition, removal of forest products through personal use firewood permits or commercial contracts could adversely affect cultural resources by introducing traffic around the sites and therefore opportunities for vandalism or removal of artifacts. Chainsaw thinning is not considered to have the potential to adversely affect cultural resources except those sites, such as culturally peeled trees or aborglyphs (cultural tree carvings), that are themselves cultural resources (USFS PSI Agreement No. 07-MU-11021200-071).

Broadcast burning poses relatively little threat to cultural resources, except for wooden architectural sites such as log cabins or corrals, and in areas where the intensity of the burn is such that it denudes all surface vegetation and topsoil. Construction of ground disturbing control lines also has the potential to disturb subsurface cultural deposit.

Although proposed activities would have the potential to cause adverse effects to cultural resources sites that are listed on the National Register of Historic Properties (NRHP), are eligible for the NRHP, or have not been adequately evaluated, these sites would be avoided in order to prevent potential adverse effects to cultural resources or a site specific mitigation plan would be developed to minimize the adverse effects. If subsequent survey or during project implementation, eligible sites

are discovered these sites would also be avoided by project activities.

The reduction of fuels in the project area would have indirect effects on historic properties in the project vicinity by reducing the probability that an uncontrolled wildfire would modify or destroy these sites. Watershed improvement projects would have indirect effects on historic properties in the project area by reducing soil erosion and improving watershed conditions thereby protecting cultural deposits that otherwise could result in artifact displacement and deterioration of delicate organic materials.

DIRECT AND INDIRECT EFFECTS – ALTERNATIVE 2

Under Alternative 2, the increase in acres of openings would increase the primary impacts on cultural resources, minimally, over the proposed action alternative; however, the total number of acres treated would decrease, thereby decreasing the overall potential impacts to cultural resources across the project area. All other effects would be the same as those listed under Alternative 1.

CUMULATIVE EFFECTS

The geographic extent for the consideration of cumulative effects on historic properties is the Tennessee Creek project area boundary from the present time to the end of project activities. All federally administered activities in the project area including (but not limited to) recreational activities and recreational site management, invasive plant treatment, wildfire and wildfire suppression, travel management and transportation system maintenance, and vegetation and fuels management are subject to National Historic Preservation Act, Section 106 compliance requirements and therefore pose relatively low risk of harm to historic properties. Historic properties will remain at some risk to inadvertent damage, loss, destruction by natural processes and human activity, but appropriate consideration and management action would be taken to protect or mitigate adverse effects to historic properties if they are discovered.

Cultural resources are non-renewable. The loss of archaeological resources has occurred in the past and will continue to occur in the future through both natural and human causes. Although efforts have been made to locate cultural resources within the project area, it is possible that there are undiscovered cultural resources that may be affected by project activities. The accumulated loss of individual cultural resources has the potential to limit our ability to understand broad patterns of human history as well as local historical events. Over time, fewer cultural resources would be available for study and interpretation. Although individual cultural resources may be impacted by proposed activities, none are eligible or potentially eligible for the NRHP.

Fisheries

EXISTING CONDITION

The aquatic analysis area includes all lakes and streams within the project area, as well as sections of Tennessee Creek and Halfmoon Creek extending downstream to three miles outside of the project boundary. Within the project area there are 64 miles of ephemeral, intermittent, and perennial stream and 1,801 acres of lake habitat. Perennial streams include the East Fork Arkansas River, Halfmoon Creek, and Tennessee Creek. Lakes include Turquoise & Emerald (Table 3.18).

Table 3.18 Stream Miles (Perennial), Lake Acres, and Fish Species Present within Project Area

Stream Name	Stream Miles	Species Present
East Fork Arkansas River	1.1	Brook and brown trout
Halfmoon Creek	7.4	Rainbow, brook and brown trout
Tennessee Creek	15	Brown and brook trout
Lake Name	Lake Acres	Species Present
Turquoise Lake	1,789	White & longnose sucker; lake, brown, rainbow, and Snake River cutthroat trout
Emerald Lake	12	Rainbow Trout

Halfmoon Creek

The project area surrounding Halfmoon Creek encompasses 7.4 miles of streams, including 6 miles of Halfmoon Creek and 1.4 miles of tributaries. Fish species present include brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo Trutta*), all non-native species. Halfmoon Creek currently contains self-sustain populations of brown trout and brook trout. Rainbow trout have been stocked recently but are not yet self-sustaining. In the forested sections, channel and bank stability appear to be good with no large areas of deposition or erosion.



Halfmoon Creek. Photo by M. Welker.

The meadow section of the stream is also characterized by a more moderate gradient and substrate comprised mostly of gravel. Within the meadow section there are several active and inactive beaver dams. These dams serve to keep the water table elevated and support a wide valley bottom dominated by willow and sedges. In some areas the dams have been breached and the channel has cut back upstream (head cut) through deposited sediments. These sections are in varying stages of

reaching equilibrium (stability). Point bars are beginning to re-vegetate and the sedge dominated banks are stable for the most part. There are short sections of broken or cracked bank scattered throughout the meadow, but this appears to be part of the natural process of the stream stabilization following a beaver dam breach.

The meadow sections contain fewer pocket pools, and have more backwater and large, deep pool habitats. Undercut banks are often associated with the deep, lateral scour pools. Undercut bank varied from a few inches to several feet in depth. The pools are connected by riffles and runs. Young of the year and juvenile trout utilize the backwater habitats. Spawning gravel appeared abundant; however, the high levels of fine sediment are likely reducing hatching success.

There is one culvert where FSR 110 crosses Halfmoon Creek. This culvert was surveyed for aquatic organism passage in 2007 and 2011. In both cases this culvert was rated as in “good” condition. However, it is likely a barrier to fish movement – especially juvenile trout during periods of high flow.

Turquoise Lake

Turquoise Lake is a 1,789 acre impoundment with a fishery comprised of brown trout, rainbow trout, cutthroat trout, lake trout, longnose sucker, and white sucker. The lake is stocked annually with brown, rainbow, and cutthroat trout and is a popular fishing destination. Turquoise Lake is part of the Fryingpan-Arkansas water development project, which delivers large volumes of water from the west to the east slope of Colorado. Turquoise Lake also has a high flushing rate and fluctuates considerably. These conditions limit primary and secondary production and are limiting factors for the fish population (Colorado Parks and Wildlife 2010).

Tennessee Creek

There are 26 miles of streams within the Tennessee Creek Watershed portion of the project area. About 15 miles are perennial with the remainder being small ephemeral tributaries. The main streams are branches of Tennessee Creek and No Name Gulch. The fish population is comprised of brook and brown trout.

Piney Gulch

One perennial stream flows through the project area on the White River National Forest – Piney Gulch. Approximately one mile of this stream flows through the project area. Piney Gulch is one of two headwaters streams that form the South Fork of the Eagle River. To date, there has been no sampling for aquatic macroinvertebrates or trout in Piney Gulch. Mitchell Creek, the other headwater stream, is dominated by non-native brown and brook trout. Mitchell Creek provides important spawning habitat for trout migrating upstream from the Eagle River (M. Grove personal observation). In addition to Piney Gulch, the Burton Ditch also flows through the project area. No information is available at this time on whether or not trout occupy the Burton Ditch.

PROPOSED, THREATENED, ENDANGERED, AND SENSITIVE SPECIES

A species list for the San Isabel National Forest, compiled by Wrigley et al. (2012), was consulted to determine if any proposed, threatened, endangered, or Forest Service species were found within the analysis area. In addition, the Region 2 Regional Forester’s Sensitive Species list (USDA Forest

Service 2011) was also reviewed for sensitive species that are known to occur on the White River National Forest (a portion of the project extends onto the White River). Table 3.19 lists species with potential to occur within the analysis area and rationale for exclusion.

There is no designated critical habitat for aquatic species within the project area. Therefore, there are no direct, indirect, or cumulative effects to critical habitat.

Proposed, Threatened, Endangered, and Forest Service Sensitive species that meet the following criteria are addressed in the effects analysis: 1) known to occur on the Forest based on confirmed sightings; 2) may occur on the Forest based on unconfirmed sightings; 3) potential habitat exists for the species on the Forest within its known historic range; or 4) potential effects may occur to these species. Based upon these criteria, only the greenback cutthroat trout was identified for further analysis.

Table 3.19 List of Proposed (P), Threatened (T), Endangered (E), or Sensitive Species (S) with Potential to Occur within the Analysis Area

SPECIES AND STATUS ¹	POTENTIAL	RATIONALE FOR EXCLUSION ²	BRIEF HABITAT DESCRIPTION AND RANGE IN COLORADO
Greenback cutthroat (T)	Yes, found in Lake Fork Cr tributary to Turquoise Lake		Well-oxygenated headwaters of mountain streams, restricted to 7 drainages on Pike-San Isabel NF, including Lake Fork Creek.
Flannelmouth sucker (S)	N	No habitat in project area	Rocky pools, runs, riffles, and backwaters of medium to large rivers, less often in small rivers and creeks-RFSS on White River.
Mountain sucker (S)	N	No habitat in project area	Clear, cold creeks and small to medium rivers with clear rubble, gravel or sand substrate-RFSS on White River.
Roundtail chub (S)	N	No habitat in project area	Rocky runs, rapids, and pools of creeks and small to large rivers; also large reservoirs in the upper Colorado River system-RFSS on White River.
Colorado River cutthroat trout (S)	N	No habitat in project area	Cool, clear water and well-vegetated stream banks for cover, thrives at high elevations-RFSS White River.
Rocky Mountain Capshell Snail (S)	N	No habitat in project area	Range is from isolated populations in Canada, one site in MT and six sites in NC Colorado. The known Colorado populations occur on the Routt and Roosevelt National Forests, in Rocky Mountain National Park, and private land in Boulder County
Caddis Fly <i>O. susanae</i> (S)	N	No habitat in project area	<i>O. susanae</i> is known from only 3 locations worldwide: New Mexico, Trout Creek Spring on the San Isabel National Forest, and the Trout Creek Spring location at High Creek Fen.

¹Status Codes: E=Federally listed endangered; T=Federally listed threatened; C= Federally candidate/proposed for listing

²Exclusion Rationale Codes: ODR=outside known distributional range of the species; HAB= no habitat present in Analysis Area; ELE= outside of elevational range of species

Evaluated Species Information

Greenback cutthroat trout (*Oncorhynchus clarkii stomias*) was once thought to be native to both the South Platte and Arkansas River Basins of Colorado. However, a recent study by Metcalf et al. (2012) determined that the greenback is native only to the South Platte River and that the native cutthroat in the Arkansas Basin is the yellowfin cutthroat (*Oncorhynchus clarkii mcdonaldi*)—now thought to be extinct. Metcalf et al. (2012) explained the role of stocking on the current distribution of cutthroat trout on the Front Range that, until recently, were believed to be pure greenback cutthroat. Of the seven populations on the Pike and San Isabel National Forest, the Bear Creek population on the Pikes Peak Ranger District appears to be the sole remaining population of pure greenback cutthroat trout. The remaining six populations, including the one in Lake Fork Creek within the project area, are mixed lineage. The U.S. Fish and Wildlife Service and the Greenback Recovery Team are working to verify the results of the study and determine the status of greenback cutthroat in Colorado. Until a new status determination is reached, all seven populations on the Pike and San Isabel National Forests will continue to be listed as threatened.

Greenback cutthroat trout are generally confined to mid- to high-elevation streams (greater than 8,200 feet) with associated high gradients. Currently occupied habitat is likely a result of non-native fish species introductions, combined with water development in downstream portions of occupied watersheds (Young 2009). Hirsch et al. (2005) noted that streams occupied by cutthroat are found primarily on public lands, mostly National Forest. Existing greenback populations are restricted to small, remote, high elevation streams and lakes where populations often have been protected by natural and man-made fish migration barriers. Many of these habitats are colder, less productive, and undergo flow fluctuations, leading to small, slow-growing trout populations.

Young (2009) and Dare et al. (2011) summarized preferred habitat for greenback cutthroat trout. In general, greenback prefer cold temperatures that are less than 20° C (68° F), but can persist at higher temperatures for short periods of time. Temperature can be a limiting factor for juvenile cutthroat survival—in streams where average summer temperatures are less than 10° C, survival of juvenile fish can be limited. Cutthroat favor pool habitats over other portions of the stream channel in nearly all seasons. Pools provide cover from predators, refuge from streamflow and inclement conditions including floods and winter ice formations. Pool habitat is particularly important for survival during the harsh winters found at mid-high elevation ranges. In addition, the amount of large woody debris present has also been shown to be positively correlated with cutthroat abundance. At larger habitat scales, cutthroat trout populations are associated with relatively pristine streams that do not contain excess amounts of fine sediment and flow through healthy and intact riparian areas (Dare et al. 2011).

Young (2009) summarized the primary threats to greenback cutthroat populations. Past habitat alteration from mining, agriculture, and water development have resulted in the extirpation or reduction of greenback populations over time. More recently, introductions and invasions of non-native trout represent the greatest cause of declines and are an impediment to restoration efforts. Current occupied habitat is likely the result of non-native trout introductions and water developments in the lower portions of watersheds. On the Grand Mesa, Uncompahgre, and Gunnison National Forests Dare et al. (2011) considered non-native species introductions to be the greatest threat. That threat comes primarily from competition with introduced brook trout and hybridization with introduced rainbow trout. Remnant populations of greenback are often found above barriers, which prevent invasion from non-native species. The Bear Creek greenback

population is a good example of a population that has persisted, but only because of these migration barriers.

Although barriers are important to population persistence, these barriers also fragment habitat and result in a lack of connectivity to other populations. That lack of connectivity renders them vulnerable in the short term to extirpation from natural disturbances such as fire, post-fire debris torrents, or floods and in the long term to loss of genetic variability and the potential for evolving in response to changing environmental conditions. This lack of connectivity also contributes to the greatest future threat to the persistence of this subspecies, climate change, because model projections suggest some suitable habitats may shift to higher elevations and precipitation patterns imply there may be large declines in late summer flows (Young 2009).

Greenback cutthroat are known to occur in Lake Fork Creek, a tributary to Turquoise Lake. This population is isolated from non-native fish below by a barrier at the wilderness boundary, which is upstream of the project area. Although the effects on greenback cutthroat will be analyzed in this document, it is highly unlikely that any individuals would be impacted by the project. Any impacts would be to individuals that drift downstream below the barrier and into the project area. The primary impact would be to habitat downstream, which could potentially support greenback introductions. However, the Arkansas River is not within the historic range of greenback cutthroat and it would likely not be a focus for future reintroduction and recovery efforts.

MANAGEMENT INDICATOR SPECIES

Amendment 30 to the Land and Resource Management Plan for the PSICC identified two aquatic MIS for the Pike and San Isabel National Forests. All species analyzed are identified in Table 3.20.

Table 3.20 Aquatic Management Indicator Species for the Pike and San Isabel National Forests Analyzed for the Tennessee Creek Project

Species	Species expected in project area?	Habitat affected by project?	Further evaluation as MIS?	Primary Habitat type
Greenback Cutthroat	No	No	No	Mid-high elevation streams
Brook Trout	Yes	Yes	Yes	Widespread

Species not expected in the project area and not affected by project activities will not be analyzed further.

Following the 2002 revision of the Forest Plan for the White River National Forest, a quantitative population trend monitoring program was implemented for aquatic MIS. A random list of approximately 50 stream segments distributed throughout combinations of different management areas representing various aspects of forest management were selected for Forest-wide trend monitoring. Streams were to be repeatedly surveyed on a five-year rotation beginning in 2003. Trends in aquatic MIS are meant to be addressed at the Forest-wide scale. To quantify trends at aquatic MIS monitoring stations, at least three or more data points are needed. With the established rotation, trend data will not be available at five year intervals until after the 2013 field season. However, additional sampling has been conducted on MIS streams in response to other ongoing

monitoring projects and/or Forest management activities. As a result there are nine sites with three or more years of macroinvertebrate data and six sites with three or more years of fish data.

For macroinvertebrates, an analysis of the data indicated that inter-annual variability in macroinvertebrate metrics did not exceed the modeled error and intra-site variability for most metrics. Therefore, no increasing or decreasing trends could be identified with available macroinvertebrate data.

The number of fish age classes as well as population densities can be useful to assess habitat in a given reach. Only six of the 50 sites have trend data available at the time of this document, all of which are located on the Eagle/Holy Cross Ranger District and do not necessarily represent fish trends Forest-wide. Of those sites, only two have more than three data points available for analysis. In general, an analysis of available fish population data did not indicate a strong increasing or decreasing trend in the existing data set. In addition, an analysis of age class distribution at the six sites detected slight increases or decreases at the reach level but overall, age classes remained well represented.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

The No Action Alternative would maintain the status quo and include only ongoing management activities. Conditions within the watershed would remain favorable for insect infestation, disease, and high-intensity wildfire. These conditions contribute to a high risk of future negative impacts to the watershed. In the absence of actions to restore the watershed to healthy conditions, insect and disease outbreaks would contribute to additional fuel loading. In turn, high fuel loading would increase the likelihood of intense wildfires—often described as catastrophic fire events. These fire events would result in increased erosion and sedimentation and would have a long-term negative impact on the aquatic habitat and existing fish populations.

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES

The proposed action provides for vegetation treatments and prescribed burning that would improve forest health by reducing fuel loading and providing greater resilience to insects and disease. Cumulatively, these actions would improve watershed health and reduce the potential impacts of catastrophic fire. Minor short-term impacts from implementation, mainly ground disturbance resulting in erosion and sedimentation, would occur. However, best management practices would reduce the duration and intensity of those impacts. Long-term positive benefits to the aquatic environment would be provided by protection from catastrophic wildfire.

In addition to vegetative treatments and prescribed burning, the proposed action also includes implementation of projects designed to improve aquatic and riparian habitats. Upon implementation, all of these actions would provide long-term positive impacts for aquatic habitat, resulting in a higher abundance of sportfish and improved fishing-quality for a heavy-use recreation area.

Stream Habitat Restoration

There are no Threatened, Endangered, Proposed, or Sensitive Species in Halfmoon Creek. Therefore, there can be no direct or indirect effects on these species. The following analysis describes the direct and indirect effects on the existing aquatic ecosystem, including habitat and biological communities.

The in-stream habitat restoration would occur over a 2.3 mile section of Halfmoon Creek. As described in the existing conditions, fish productivity is limited by available low-velocity habitat and stream sedimentation. Habitat restoration work conducted in the 1980's was somewhat effective, but the improvements were inadequate and the structures are now in need of replacement and refinement. The proposed restoration project would involve placement of structures and restoration activities at 112 locations within the 2.3 mile section.

The principal limiting factors to the fishery are the scarcity of low-velocity habitat and sedimentation from eroding banks and denuded riparian habitat. The proposed restoration actions would improve habitat complexity and quality for resident fish populations. Bank stabilization and in-stream structures would provide cover, velocity shelter, and refugia for various life stages of fish. Restoration of riparian areas would improve the quantity and quality of riparian vegetation along the river. Riparian vegetation is important to fish because it helps maintain stream channel profiles by protecting banks with soil-binding roots and shielding banks from erosion. It also provides cover, controls temperature, and provides nutrients for aquatic and terrestrial fish food organisms. Full implementation of the stream restoration would reduce erosion and subsequent sedimentation in the stream, resulting in improved spawning habitat and a greater density of macroinvertebrates.

Design Criteria have been developed to minimize these short-term adverse effects. In the long-term, the restored sections of stream would improve the quality of the fishery and provide for additional recreational activity.

In summary, short-term adverse impacts are expected during implementation. Project activities, such as gathering rock and tree material, and accessing the river channel would cause short-term ground disturbance and loss of surface vegetation. Soil disturbance from the use of mechanized equipment would likely add some sediment to the stream. Although some erosion and sedimentation is anticipated, the effects are expected to be minimal and localized to the area. Thus, no indirect adverse impacts are expected downstream of the project area.

Over time, long-term direct and indirect benefits are anticipated. The addition of instream structures and rehabilitation activities are expected to result in improved fish habitat, reduced erosion and sedimentation, and improved water quality within the 2.3 mile section. These effects are anticipated to extend well below the project area into downstream sections of Halfmoon Creek. These beneficial impacts would result in improved survival of stocked fish, an increase in fish density, and a much improved recreational fishery.

PROPOSED, THREATENED, ENDANGERED, AND SENSITIVE SPECIES

This effects analysis for aquatic resources is based on the assumption that the design criteria listed in the proposed action would be fully incorporated into project implementation and that no treatment other than prescribed fire would occur in the watershed influence zone.

The effects determination for greenback cutthroat trout is based upon the following:

- There are no known greenback cutthroat trout within the project area. A greenback population is known to occur upstream of the project area in Lake Fork Creek. That population is separated from the downstream fishery by a natural barrier. Although downstream drift could occur, past surveys in Turquoise Lake have not documented greenback cutthroat. It appears highly unlikely that individual greenback would move below the barrier and into the project area.
- Should individual greenback drift downstream into the project area, the best management practices would provide protection from any habitat degradation.
- A recent study has documented that greenback cutthroat are not native to the Arkansas River Basin. Although the status determination remains as threatened for the Lake Fork Creek population, it is unlikely that any future greenback transplants and recovery actions will occur within the project area (i.e., it is outside the historic range). Thus, potential future recovery efforts would not be impacted by this action.

The determination for greenback cutthroat trout is “*No Effect*”.

No direct or indirect effects to greenback cutthroat from implementation of the Tennessee Creek Project are anticipated. Since there are no direct or indirect effects anticipated to greenback cutthroat from this project, there can be no cumulative effect.

MANAGEMENT INDICATOR SPECIES

Direct effects to brook trout populations and habitat would be minimal. Best management practices have been incorporated into the project design to minimize or negate any short term impacts resulting from erosion and sedimentation. The implementation of aquatic and riparian habitat improvement projects are anticipated to provide a long-term indirect benefit. Over time these projects would result in reduced erosion and sedimentation, improved instream habitat, and enhanced water quality. These beneficial impacts are expected to occur within the project boundary and downstream of the project in Halfmoon Creek.

With the implementation of any of the proposed alternatives, no change in trout or macroinvertebrate species is expected. Therefore, these activities would neither contribute towards nor negatively affect meeting Forest-wide aquatic MIS objectives of improving habitat quality within 15 years.

CUMULATIVE EFFECTS

In areas of concentrated public recreation use (e.g., roads, formal and dispersed camping areas, and hiking trails) effects to aquatic resources would contribute to the cumulative impacts of this project. Roads, in particular, contribute to habitat fragmentation, increased erosion and sediment deposition into nearby streams. The presence of fine sediments in streams adversely affects fish assemblages.

Formal and dispersed camping, in general, contribute to loss of riparian vegetation because preferred camping areas are often located near streams. The concentrated use in and around these riparian zones results in trampling riparian vegetation and an increase in bare ground. The loss of riparian vegetation and an increase in bare ground would cause elevated erosion rates and increased sedimentation into nearby streams. Trails would continue to impact riparian systems and

aquatic habitat for the long-term through erosion and also through habitat fragmentation from trail-stream crossings. In areas where general recreation use is low (e.g., backcountry), effects from public recreational activities may be of less influence on aquatic species.

Increased use of OHVs for recreational use has resulted in an extensive “user-created” network of trails and travel routes. The proposed use of previously decommissioned roads for timber removal would likely lead to increased use by the general public while these roads are open, and may lead to new user-created routes. These new routes would become more established over time and eventually would be viewed by the public as system routes. The continued creation of new roads/trails would increase erosion and sedimentation, negatively impacting riparian systems and aquatic habitat. Human access facilitated by roads/routes may also increase the likelihood of human caused wildfires and the spread of invasive plant and aquatic species.

The human population growth has increased an average of 2.5 percent over the past decade, and this population growth is predicted to continue. In addition, housing units and human developments within wildland/urban interface areas near the Forest substantially increase the risk of wildfires on the Forest that also would impact greenback habitat.

Other future non-federal activities that are likely to occur include mining and vegetation treatments (e.g., mechanical harvest and/or prescribed fire).

Hydrology/Soils

EXISTING CONDITION

The project area is located within seven, 6th-level watersheds in the predominantly subalpine zone in the headwaters of the Upper Arkansas River basin. With the exception of the South Fork Eagle River Watershed (Eagle County, White River National Forest), all of the remaining watersheds are tributary to the Arkansas River. The South Fork Eagle River is tributary to the Eagle River which then flows into the Colorado River. The majority of the project is located in Lake County within the San Isabel National Forest.

Table 3.21 displays the number of project acres within each of the seven 6th-level watersheds. Nearly 88 percent of the project area lies within the Halfmoon Creek, Tennessee Creeks, and Turquoise Lake 6th-level watersheds.

Table 3.21 6th-level Watershed (area in acres) located in the Project Area

Watershed	6th-level Area	Project Area	% of 6th-Level Watershed	% of Project Area
City of Leadville - Arkansas River	42,204	960	25.4%	5.8%
East Fork Arkansas River	32,852	435	19.8%	2.6%
Halfmoon Creek	16,092	1,779	9.7%	10.8%
Tennessee Creeks	29,636	8,597	17.8%	52.4%
Turquoise Lake	17,637	4,025	10.6%	24.5%
Willow Creek	15,532	163	9.4%	1.0%
South Fork Eagle River	12,162	462	7.3%	2.8%
Totals	166,115	16,421	100.0%	100.0%

By analyzing the soil survey, the project area falls mainly into the following climatic zones: subalpine, montane, and montane dry. The latter two have been combined as montane for simplicity in the following tables. Table 3.22a, Part 1 summarizes the elevation range, mean annual air and soil temperatures, the number of frost-free days, and the monthly occurrence of those frost-free days for each climatic zone.

Table 3.22a Climatic Information, Part 1.

Climatic Zone	Elevation (feet)	Air Mean Annual Temp (° F)	Soil Mean Annual Temp (° F)	Frost Free Days (Count)	Frost Free Days (Months)
Subalpine	9,000 - 11,800	34 - 40	32 - 38	30 - 50	July - August
Montane	6,500 - 10,500	36 - 44	34 - 42	50 - 70	Mid-June - mid-August

Table 3.22b, Part 2 summarizes mean annual precipitation and snowfall amounts, the dominant rainfall months, and when snowfall begins and ends for different facing slope aspects. Information for these two tables was compiled from the Northern San Isabel and Western Pike National Forests Colorado Soil Survey (Irvine 1995).

Table 3.22b Climatic Information, Part 2.

Climatic Zone	Mean Annual Precipitation (inches)	Mean Annual Snowfall (inches)	Dominant Months of Rainfall	Snowmelt Begins/Ends	Aspect for Snowmelt
Subalpine	20 - 40	300 - 400	June - August	June - July May - June	North Planar, South
Montane	20 - 30	200 - 300	June - September	June - July May - June April - June	North Planar South

The Halfmoon Creek near Malta, Colorado stream gage is located within the southern-most portion of the project boundary. Information from the gaging station shows flows begin to rise in the middle of April, peaks in the latter half of June, and recedes to base flow conditions generally by mid-December.

There are extensive riparian complexes within the project area that include many unique features such as kettle lakes. These lakes were formed as the result of glaciation. Surveys of some of these kettle lakes were surveyed in the fall of 2011, and those surveyed were found to be in excellent condition. For additional information on these lakes within the project area, please refer to *"The Kettleholes of the West Tennessee Valley, Lake County, Colorado"* September, 1989 report.

In addition to these kettle lakes, Turquoise Lake, Emerald Lake, and several diversion structures are also located within the project boundary.

Soil types underlying lodgepole pine forests that have a low erosion hazard within the proposed project area are listed in Table 3.23. As defined in the survey, "a rating of low means that the soil has a mixture of sand, silt and clay and has relatively high organic matter content, creating strong structure" (Irvine 1995).

Table 3.23 Soil Types with Low Erosion Hazard (acres)

Watershed	562M	610G	620G	625G	693G	701M	752M	760M	W367B	Total
City of Leadville-Arkansas River					59.6	22.6				82.2
East Fork Arkansas River	239.3									239.3
Halfmoon Creek		293.4		172.4	484.5					950.3
Tennessee Creeks	580.7	199.4	711.1	420.5	90.2	72.5	474.9	250.4	213.7	3013.4
Turquoise Lake		371.5		215.8		21.6		127.3		736.2
Willow Creek					48.3					48.3
Total	820.0	864.3	711.1	808.7	682.6	116.7	474.9	377.7	213.7	5069.7

The following soil map units have been identified as restrictive (e.g., moderate to steep slopes and saturated soils): 100F, 190F, 512S, 515S, 609G, 619G, 670G, 690G, 691G, 750S, 751S, 754Y and 770S. While soil map units 515S and 754Y have a high erosion hazard rating, the remaining units have a moderate erosion hazard rating. As defined in the survey, "a rating of moderate means soils have moderate inherent erodibility and are generally on moderate to steep slopes. These soils are more easily dispersed by raindrop impact and may require more expense to control erosion and sedimentation" (Irvine 1995).

Approximately 2,450 acres of lodgepole pine forests have been mapped with moderate erosion hazard and 190 acres of lodgepole pine forests have been mapped with a high erosion hazard. See the Soil and Hydrology Specialist Report for the Tennessee Creek Project for mapped areas.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

No additional acres outside those ongoing projects identified under the No Action Alternative would be treated. Therefore no additional ground disturbance would occur from timber-related or prescribed fire activities or road construction described under this project. No existing decommissioned roads would need to be re-opened and no new temporary roads would be required. Erosion and sedimentation rates would occur at the same levels that presently exist; calculating these amounts is beyond the scope of this project and not necessary for comparison between the alternatives.

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES

General Environmental Consequences

The next three paragraphs are taken from Management Measure 11.1 of the Watershed Conservation Practices handbook; these paragraphs do a good job of summarizing the effects of natural and anthropogenic disturbances that reduce the density of live vegetation.

“Land treatments that reduce the evapotranspiration of a watershed or reduce the ability of the watershed to infiltrate and store water will result in an increase in runoff. Land treatments should be implemented in consideration of the ability of the stream to absorb increases in runoff given the effects of the proposed activity in conjunction with other natural or anthropogenic disturbances in the watershed. The ability of a particular stream to be able to accommodate increases in runoff and sediment transport without being damaged depends upon stream type, past disturbances and current stream condition.”

“Any disturbance that reduces the density of live vegetation cover will increase runoff from forested watersheds. These disturbances can be natural, such as a wildfire or insect and disease outbreaks, or anthropogenic like timber harvest or fuels treatments. In snow dominated areas, flow increases occur mostly during spring runoff on the rising limb of the hydrograph, and are not measurable until about 25 percent of the basal area of a forested watershed is affected. The increase in the size of peak flows is proportional to the amount of basal area affected. However, any reduction in forest cover will have a progressively smaller effect on peak flows with increasing flow magnitude or recurrence interval. Also, increases in runoff are generally proportional to annual precipitation, that is, greater increases occur in wetter areas. And, the increase in runoff declines over time with vegetation regrowth. Conversely, large openings (opening diameter greater than 15 times the height of surrounding trees) can be subjected to snow scour that can actually reduce site moisture and runoff. (EPA 1980; MacDonald and Stednick 2003; Ice and Stednick 2004).”

“Increased runoff and sediment caused by soil disturbances are the major source of stream impacts. Roads and other soil disturbances can impair the ability of the land to absorb water and filter sediment. Roads, soil disturbances and vegetation treatments can increase small peak flows and channel erosion, but stream health is not damaged if watershed conservation practices are used. Connected disturbed areas are the main source of damage in all regions (Jones and Grant 1996; Troendle and Olsen 1994; Ziemer 1981).”

Roads

It is estimated that project roads would consist of re-opening approximately 1.7 miles of existing decommissioned roads and constructing approximately 21 miles of new, temporary roads over the life of the project. Based on that estimate, approximately 69 acres of disturbance would result from 22.7 miles of project roads.

There would be a pulse of erosion from the use of temporary roads during the first two years following temporary road construction or reopening closed roads. New temporary roads would be closed following use. Project design criteria and BMPs have been developed to minimize the amount of sedimentation produced from activities. The amount of erosion occurring from these roads and leaving the road surface as sediment is summarized in Table 3.24. These amounts are summarized by 6th-level watershed, and they were calculated using the Water Erosion Prediction Project (WEPP) model.

Long term soil productivity would not be impaired. Soil loss rates would increase over the No Action Alternative, however, predicted soil loss rates were generally below threshold levels except on the steeper units. Soil condition would be affected by the soil disturbance caused by the use of mechanical equipment; however effects would be within forest plan standards and guidelines with the implementation of design criteria and BMPs. Monitoring of BMP implementation and corrective actions would ensure BMPs are implemented.

For the purpose of comparative analysis, it was assumed that all temporary roads would be constructed and decommissioned roads re-opened in one year. In reality, these roads would be phased in over time, and thus the annual sediment leaving the road prisms would be less and correspond to the actual mileage re-opened and/or constructed. In addition, as treatments are completed in an area and the temporary or re-opened commissioned roads are closed and reclaimed, the annual amounts of sediment eroded and leaving the road prism would be greatly reduced.

Table 3.24 Estimated Sediment Yield (tons/mile/year) for Temporary Roads by 6th-level Watershed

Sediment Yield	City of Leadville - Arkansas River	East Fork Arkansas River	Halfmoon Creek	Tennessee Creek	Turquoise Lake	Willow Creek	South Fork Eagle River	Totals
Roads(miles)	1.6	0.9	2.9	14.3	2.8	0.5	0.0	22.9
Sediment leaving road (tons/year)	24.8	9.9	47.8	155.9	37.7	3.3	0.0	279.4
Sediment yield (tons/mile/year)	15.2	11.6	16.4	10.9	13.6	7.3	0.0	12.2

The re-opening of decommissioned roads and the construction of temporary roads and skid trails associated with treating the forest stands within the project area would have a direct effect on the hydrology of the watershed. In addition to altering the flow patterns of surface and groundwater, sediment and debris eroding from these disturbed surfaces can affect water quality directly and indirectly.

The other major change resulting from the proposed project would be the reduction in vegetative cover. When forest cover is removed, there is a direct reduction in transpiration, and a direct loss of interception by that cover. With the loss of cover, subsequent energy from precipitation would impact the forest floor directly. This surplus water which previously was intercepted and consumed by the forest cover would be available for infiltrating into the soil, supporting new plant growth and recharging the vadose (unsaturated zone) and unconfined aquifers. When soils become saturated, the surplus water then becomes available as overland flow and has the ability to transport sediments, organic matter, and other materials via flow patterns to connecting streams. Evaporation from free water surfaces within treated areas may also increase.

Once a treatment has occurred, the remaining slash would begin the process of decomposition. This process would return the remaining organic matter and nutrients from the treatments to the soil. While the slash decays, it provides cover and serves to reduce the raindrop impact from precipitation, makes for a tortuous path for any overland flow that might occur, and creates microclimates. These sites would be important for re-establishing new vegetative growth including tree seedlings.

Fire can accelerate this decomposition process. Where excessive amounts of slash remain from a proposed treatment, prescribed fire may be used to reduce it. When piles are burned, intense heat can be generated and this heat can sterilize the soil beneath the piles. To overcome this issue, the localized disturbance can be reclaimed by breaking up the burned surface and adding some topsoil and organic matter from areas immediately adjacent to affected site. A similar approach can be applied to “hotspots” that result from broadcast burns. Extra care and attention should be given to the soils that have moderate to high erosion hazards (see Existing Condition for these soil types).

Pre-commercial thinning of lodgepole pine is also planned within the project area. The same effects described previously would apply to these stands albeit on a much smaller scale. What is important to note is the ability of these previously treated stands to regenerate; it is an indication of site productivity in those locations. One would expect that proposed treatments which create openings in the lodgepole pine on similar site conditions would also be successful in re-establishing a new, lodgepole pine forest.

CUMULATIVE EFFECTS

Tennessee Creeks 6th-level Watershed

Cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would initially impact those tributaries feeding primarily East and West Tennessee Creeks. Other smaller tributaries to the mainstem of Tennessee Creek would also realize impacts proportional to the treatments occurring within those drainages. Collectively, all cumulative effects resulting from timber activities, road construction, and prescribed fire within this watershed would be delivered to the confluence where Tennessee Creek joins the East Fork Arkansas River.

Approximately 3,500 of the 4,800 acres (74 percent) of lodgepole pine within the Tennessee Creeks 6th-level watersheds have a low erosion hazard. These would likely be the first acres treated based on ease of access, slope, and the like. Of the total lodgepole pines acres within this 6th-level watershed, approximately 680 acres are part of the Northwest Hazardous Fuels Project, 45 acres have been clearcut, and 60 acres are within developed recreational sites (Note: this information was compiled from the R2Veg data layer used for this project). It is likely that most of these acres are within the low erosion hazard acres. Most of the cumulative effects derived from project implementation would be generated from the remaining 2,700 acres of low hazard acres before treatment would begin on the steeper ground (i.e. moderate erosion hazard).

East Fork Arkansas River 6th-level Watershed

Cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would initially impact those few unnamed tributaries feeding the East Fork of the Arkansas River. Collectively, all cumulative effects resulting from timber activities, road construction, and prescribed fire within this watershed would be delivered to the confluence of Tennessee Creek and the East Fork Arkansas River.

Approximately 240 of the 280 acres (87 percent) of lodgepole pine within the East Fork Arkansas River 6th-level watershed have an erosion hazard of low. These would likely be the first acres treated based on ease of access, slope, and the like. Most of the cumulative effects derived from project implementation would be generated from these low hazard acres.

Turquoise Lake 6th-level Watershed

Cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would directly impact those tributaries feeding Turquoise Lake. Collectively, all cumulative effects resulting from timber activities, road construction, and prescribed fire within this watershed would be delivered to the Lake Fork of the Arkansas River via Turquoise Lake. Treatments within this watershed could have beneficial effects to the amount of sediment delivered to Turquoise Lake, both a benefit in terms of storage preserved and improved water quality.

Approximately 1,000 of the 2,100 acres (47 percent) of lodgepole pine within the Tennessee Creeks 6th-level watersheds have a low erosion hazard. These would likely be the first acres treated based on ease of access, slope, and the like, and most of these acres lie above the steeper slopes surrounding the reservoir including the more gentle slopes in and around the recreational facilities on the east end of Turquoise Lake. Of the total lodgepole pines acres within this 6th-level watershed, approximately 16 acres have been clearcut and 104 acres are within developed recreational sites (Note: this information was compiled from the R2Veg data layer used for this project). Most of these acres are within the low erosion hazard acres. Most of the cumulative effects derived from project implementation would be generated from the remaining 880 acres of low hazard acres before treatment would begin on the steeper ground (i.e. moderate erosion hazard).

City of Leadville - Arkansas River 6th-level Watershed

Because of the unusual shape of this watershed, cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would initially impact those tributaries/subsurface flow feeding the reach of the Lake Fork

branch of the Arkansas River below Turquoise Lake and above its confluence with the mainstem of the Arkansas River and additionally to the reach of the Arkansas River below its confluence with Tennessee Creek and the East Fork Arkansas River and its confluence with the Lake Fork branch of the Arkansas River. Collectively, all cumulative effects resulting from timber activities, road construction, and prescribed fire within this watershed would be delivered to these two reaches.

Approximately 480 of the 620 acres (77 percent) of lodgepole pine within the City of Leadville – Arkansas River 6th-level watersheds have a low erosion hazard. These would likely be the first acres treated based on ease of access, slope, and the like. Of the total lodgepole pines acres within this 6th-level watershed, approximately 20 acres have been clearcut (Note: this information was compiled from the R2Veg data layer used for this project). It is likely, that these acres are within the low erosion hazard acres. Most of the cumulative effects derived from project implementation would be generated from the remaining 460 acres of low hazard acres before treatment would begin on the steeper ground (i.e. moderate erosion hazard).

Willow Creek 6th-level Watershed

Cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would initially impact South Willow Creek which is tributary to Willow Creek. Collectively, all cumulative effects resulting from timber activities, road construction, and prescribed fire within this watershed would be delivered to the confluence of where Willow Creek joins the Lake Fork branch of the Arkansas River.

Approximately 50 of the 160 acres (31 percent) of lodgepole pine within the Willow Creek 6th-level watershed have a low erosion hazard. These would likely be the first acres treated based on ease of access, slope, and the like. Of the total lodgepole pines acres within this 6th-level watershed, approximately 8 acres have been clearcut (Note: this information was compiled from the R2Veg data layer used for this project). It is likely, that these acres are within the low erosion hazard acres. Most of the cumulative effects derived from project implementation would be generated from the remaining 42 acres of low hazard acres before treatment would begin on the steeper ground (i.e. moderate erosion hazard).

Halfmoon Creek

Cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would initially impact the unnamed tributaries and the mainstem of Halfmoon Creek. Collectively, all cumulative effects resulting from timber activities, road construction, and prescribed fire within this watershed would be delivered to the confluence of where Halfmoon Creek joins the Lake Fork branch of the Arkansas River.

Approximately 980 of the 1,340 acres (73 percent) of lodgepole pine within Halfmoon Creek have a low erosion hazard. These would likely be the first acres treated based on ease of access, slope, and the like. Of the total lodgepole pines acres within Halfmoon Creek, approximately 65 acres have been clearcut and approximately 45 acres are within developed recreational sites (Note: this information was compiled from the R2Veg data layer used for this project). It is likely, that most of these acres are within the low erosion hazard acres. Most of the cumulative effects derived from project implementation would be generated from the remaining 870 acres of low hazard acres before treatment would begin on the steeper ground (i.e. moderate erosion hazard).

Combined Cumulative Effects for all Arkansas River 6th-level Watersheds

In addition to Halfmoon Creek, effects delivered from the Turquoise Lake, the City of Leadville - Arkansas River (portion tributary to the Lake Fork branch only), and Willow Creek 6th-level watersheds are also cumulatively delivered to the Halfmoon and Lake Fork branch of the Arkansas River confluence. In turn, once the flow of the Lake Fork branch of the Arkansas River joins the mainstem of the Arkansas River, the entire cumulative effects of the project can now be realized as the effects from the 6th-level watersheds of the Tennessee Creeks, East Fork Arkansas River, and City of Leadville - Arkansas River (portion tributary to the mainstem Arkansas River only) components are comingled together.

South Fork Eagle River Watershed

Any treatments occurring on Ski Cooper are tributary to the South Fork Eagle River. In turn, cumulative effects from project activities resulting either in a change to the hydrologic cycle, soil conditions, or in a change to water quantity and quality would initially impact the South Fork Eagle River. The South Fork Eagle River is tributary to the Eagle River and subsequently to the Colorado River. The majority of Ski Cooper is on the White River National Forest.

Cumulative effects resulting from treatments in the aspen and spruce-fir forests would be similar to those described above for the lodgepole pine forest and by-products (e.g., sediment, etc.) resulting from those effects would also be delivered in a similar manner to those reaches previously described for each watershed. Positions of these stands within the watershed would determine where resulting impacts would enter the various streams.

In addition to the positive changes that could result from implementing the proposed treatments, positive improvements to some of the watersheds would also occur through specific watershed improvement projects. For example, a more natural sediment regime would be realized in the Halfmoon Creek watershed by implementing the channel restoration and road-water crossing stabilization projects. Where culverts are currently hindering flow and fish passage, both improved flow and fish passage would be realized where culverts are replaced. Breaking up compacted soils in high-traffic areas (i.e. developed sites) could improve infiltration and reduce erosion (reducing the erosive energy of overland flow).

The actual cumulative effects would be directly proportional to the actual acres treated, road miles constructed, and acres burn. It is estimated that treatments would average between 100 to 200 acres per year. This amount could increase. One could expect a range between 2,000 acres to the maximum allowable under each action alternative to be treated over the course of a ten year period.

Botany

EXISTING CONDITION

Quaking aspen occurs on flat to moderately steep terrain on all aspects. Soils are generally deep, mollic, cool, and moist. Aspen is adapted to a broader range of environments than many plants associated with it. Aspen exists in single-storied or more commonly multi-storied stands. Conifers are encroaching in many areas. Understory consists of an abundant herbaceous component, with

snowberry (*Symphoricarpos* spp.), Fendler's meadow rue (*Thalictrum fendleri*), and common yarrow (*Achillea millefolium*) present (Landfire 2007).

Lodgepole pine occurs in subalpine, relatively moist areas. Stands are often on well-drained, residual, or glacial substrates in shallow soil. The dominance of lodgepole pine is related to fire history and edaphic conditions. Lodgepole pine is generally persistent and not replaced by other trees. The understory is usually sparse. Stands are sometimes intermingled with other conifers or aspen. The shrub layer may be conspicuous or absent. Common species may include kinnikinnick (*Arctostaphylos uva-ursi*), snowbrush ceanothus (*Ceanothus velutinus*), twinflower (*Linnaea borealis*), creeping barberry (*Mahonia repens*), russet buffaloberry (*Shepherdia canadensis*), dwarf bilberry (*Vaccinium caespitosum*), grouse whortleberry (*Vaccinium scoparium*), and currants (*Ribes* spp.) (Landfire 2007).

Spruce-fir occurs in the subalpine zone on gentle to moderately steep terrain. Sites within this system are cold year-round, and precipitation is predominantly snow, which may persist until late summer. The overstory is typically dominated by Engelmann spruce. Other tree species may include lodgepole pine and aspen (Landfire 2007).

Alpine tundra is above timberline. It is found on gentle to moderately slopes, flat ridges, valleys and basins, where the soil has become relatively stabilized and the water supply is more or less constant. This system is characterized by a dense cover of low-growing, perennial graminoids and forbs. Rhizomatous, sod-forming sedges are the dominant graminoids, and prostrate and mat-forming plants with thick rootstocks characterize the forbs. Dominant species include alpine sagebrush (*Artemisia scopulorum*), blackroot sedge (*Carex elynoides*), dryspike sedge (*Carex siccata*), northern singlespike sedge (*Carex scirpoidea*), Hepburn's sedge (*Carex nardina* var. *hepburnii*), curly sedge (*Carex rupestris*), tufted hairgrass (*Deschampsia caespitosa*), alpine fescue (*Festuca brachyphylla*), Idaho fescue (*Festuca idahoensis*), Ross's avens (*Geum rossii*), dwarf phlox (*Phlox condensata*), and alpine clover (*Trifolium dasyphyllum*). Although alpine tundra dry meadow is the matrix of the alpine zone, it typically intermingles with alpine bedrock and scree, fell-field, and alpine/subalpine wet meadow systems (Landfire 2007).

Grass/forb communities are found on mountain slopes ranging from nearly level to very steep topography. Aspect varies, however the larger patches are on southern exposures and on summit plains. Soils are moderately deep to deep Typic to Pachic Cryoborolls and Argiborolls/Haploborolls. Dominant grasses may include Thurber fescue (*Festuca thurberi*), Arizona fescue (*Festuca arizonica*), sheep fescue (*Festuca ovina*), mountain muhly (*Muhlenbergia montana*), Parry's oatgrass (*Danthonia parryi*), and nodding brome (*Bromus anomalus*). Moister sites may also have tufted hairgrass (*Deschampsia caespitosa*) and various sedges (*Carex* spp.) (Landfire 2007).

The riparian systems often occur as linear stringers of one or more of the following vegetation forms: willows; sedges and other herbaceous vegetation; and conifers. The most widespread in the proposed project area are shrublands occurring as narrow bands lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains. Occurrences can also be found around seeps and isolated springs on slopes away from valley bottoms. Slope varies from one to ten percent. Soils are deep to very deep, mostly cryic, well-developed mollic horizon, somewhat poorly to very poorly drained. The dominant shrubs reflect the large elevational gradient and include gray alder (*Alnus incana*) and willows (*Salix* spp.). Generally the upland vegetation surrounding these riparian systems is of either conifer or aspen forests. Sedges, rushes (*Juncus* spp.) and numerous grass species are common (Landfire 2007).

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES

The U. S. Fish and Wildlife Service has identified two federally listed species as having part of their range on the Pike and San Isabel National Forests. These species are the threatened Penland's alpine fen mustard (*Eutrema penlandii*) and the threatened diluvium ladies' tresses (*Spiranthes diluvialis*).

There are no documented occurrences of, nor habitat for, Penland's alpine fen mustard or diluvium ladies' tresses within the proposed project area, so the proposed project will have no effect on this species. As a result, consultation with U. S. Fish and Wildlife Service was not required.

REGIONAL FORESTER'S SENSITIVE SPECIES

The threatened, endangered, and RFSS list for the PSICC was used to identify those species that could occur in the project area. Based on that and research of other records (e.g., Colorado Natural Heritage Program 2010), it was determined that the habitat in the project area could be suitable for five of the species. The full table is available in the Biological Assessment and Biological Evaluation for Threatened, Endangered and Sensitive Plant Species.

Only the species that may occur or have habitat that could be affected by the project will be carried forward in the analysis. Other species are excluded from detailed analysis because this project is outside their distributional range, the area does not have habitat for them, the action alternatives would not affect the species or its habitat, or other reasons stated in the Biological Assessment and Biological Evaluation for Threatened, Endangered and Sensitive Plant Species.

Five species on the RFSS list have potential to occur within the proposed project area, but they have not been documented as occurring there.

Trianglelobe moonwort

Trianglelobe moonwort (*Botrychium ascendens* W.H. Wagner) is a perennial herb in the adder's-tongue family (Ophioglossaceae). Sporulation occurs in mid-summer (FNA 1993+). Trianglelobe moonwort is found in montane forests (NatureServe 2011). It has been found in moist gravelly soil in periodically disturbed areas (Beatty, et al., 2003). Trianglelobe moonwort ranges from AK south to NV and CO, and in ON (FNA 1993+). It is known to occur in the Mosquito-Gore Range as defined by McNab, et al. (2007). There is one known site on the PSICC.

Trianglelobe moonwort is ranked G2G3 by NatureServe (2011). Having only recently been discovered in CO, it is not yet ranked by CNHP. Threats may include road construction and maintenance, unregulated recreation, herbicide use, and livestock grazing (Beatty, et al., 2003). No trend data are available because this has only recently been found in the state.

Narrowleaf moonwort

Narrowleaf moonwort [*Botrychium campestre* ssp. *lineare* (W.H. Wagner) Farrar] is a perennial herb in the adder's-tongue family (Ophioglossaceae). This species includes individuals that had been tentatively known as "forkleaved moonwort." This species emerges earlier than other moonworts. Sporulation occurs from spring through late July. Narrowleaf grapefern is found in stabilized subalpine areas, 20 to 60 years after disturbance. Narrowleaf grapefern ranges from WA, AB, and QC south to OR, NM, WI, and NY. There are more than fifty known sites in CO, most discovered since 2004 (Farrar and Popovich 2010). There are at least six known sites on the PSICC.

Narrowleaf grapefern is ranked G3G4 by NatureServe (2011). It is tracked by CNHP and is ranked S1. Threats to the species may include road maintenance, mining, habitat loss, over-grazing, and succession. It may respond favorably to light or moderate disturbances. No trend data are available.

Within the Mosquito-Gore Range as defined by McNab, et al. (2007), records are in Lake County. These lie within the headwaters Arkansas River (fifth level), and City of Leadville-Arkansas River (sixth level) watersheds. Vegetation may be characterized as grass/forb, tundra, barren, riparian shrub, and spruce-fir. The elevation ranges from 10,500 to 11,500 feet. These areas are underlain by granitic rocks of 1,700-M.Y. age group; granitic rocks of 1,400-M.Y. age group; biotitic gneiss, schist, and migmatite; and Leadville limestone, Williams Canyon limestone, Manitou limestone, and Sawatch quartzite (Tweto 1979).

Narrowleaf moonwort has been found in the Sawatch Range as defined by McNab, et al. (2007). Vegetation is characterized as riparian tree, spruce-fir, and barren. Elevation ranges from 10,000 to 12,500 feet. Sites are underlain by Glacial drift of Pinedale and Bull Lake glaciations; pre-ash-flow andesitic lavas, breccias, tuffs, and conglomerates; Leadville limestone, Williams Canyon limestone, Manitou limestone, and Sawatch quartzite; Leadville limestone, Williams Canyon limestone, and one or more Ordovician formations; and felsic and hornblendic gneisses (Tweto 1979).

Paradox moonwort

Paradox moonwort (*Botrychium paradoxum* W.H. Wagner) is a perennial herb in the adder's-tongue family (Ophioglossaceae). Sporulation occurs in mid-summer (FNA 1993+). Paradox moonwort is found in montane forests (NatureServe 2011). It ranges from BC and SK south to OR, UT, and CO. It has been found on the White River National Forest, but not on the San Isabel National Forest.

Paradox moonwort is ranked G3G4 by NatureServe (2011). Having only recently been discovered in CO, it is not yet ranked by CNHP. Threats may include: road construction and maintenance, unregulated recreation, herbicide use, and livestock grazing. No trend data are available because this has only recently been found in the state.

Weber's draba

Weber's draba (*Draba weberi* Price & Rollins) is a perennial herb in the mustard family (Brassicaceae or Cruciferae). It flowers from late June through July (Decker 2006). Weber's draba occurs on streamside rocks and on rocks in moist spruce-fir forests. Elevation is from 11,000 to 11,500 feet. It is on northeast aspects.

It is endemic to a small area in central CO. There are three known sites for Weber's draba. One of these is on the PSICC. Weber's draba is known from the Mosquito-Gore Range as defined by McNab, et al. (2007). Sites are underlain by biotitic gneiss, schist, and migmatite (Tweto 1979). Soils are mapped as Moran family, 40 to 65 percent slope (Irvine in prep.). Other records are found to the north of the PSICC.

Weber's draba is ranked G1 by NatureServe 2011). It is tracked by CNHP and is ranked S1.

Selkirk's violet

Selkirk's violet (*Viola selkirkii* Pursh ex Goldie) is a perennial herb in the violet (Violaceae). It flowers in May to June (Spackman, et al., 1997). Selkirk's violet is found in lower montane to montane areas on mountain slopes. It has been found at elevations from 7,300 to 11,100 feet (Elliott and Smith

2010). It occurs in cold, moist forests near mountain streams (Spackman, et al., 1997; Elliott and Smith 2010).

Selkirk's violet is circumboreal in range. In North America it is found from BC to Greenland south to WA and NM. Four sites are known on the PSICC. Within the Mosquito-Gore Range as defined by McNab, et al. (2007), Selkirk's violet is known on northeast aspects with slopes of 30 to 60 percent. Elevation is between 11,000 and 11,500 feet. It is underlain by biotitic gneiss, schist, and migmatite; and Leadville limestone, Williams Canyon limestone, Manitou limestone, and Sawatch quartzite (Tweto 1979). Soils are mapped as cirque land (Irvine in prep.). Vegetation is characterized as spruce-fir and barren.

Selkirk's violet is ranked G5? by NatureServe (2011). It is tracked by CNHP and is ranked S1 because of its disjunct populations. It may be threatened by unregulated motorized recreation. No trend data are available.

DIRECT, INDIRECT AND CUMULATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS – NO ACTION

There would be no direct effects to RFSS plants or their habitat, as a result of the No Action Alternative. However, the No Action Alternative would perpetuate hazardous fuel accumulation and, subsequently, the potential for high-intensity or stand-replacing wildfire would continue to increase. The effects of high-intensity or stand-replacing wildfire on plant species and habitat would vary from negligible to moderate, depending on the species, habitat type affected, and fire intensity.

The No Action Alternative would not result in any short-term direct effects on any of the RFSS, but may have long-term indirect effects as a consequence of non-action, such as the accumulation of understory or ladder fuels, continued conifer encroachment into aspen and meadow habitats, and increased potential for high-intensity or stand-replacing wildfires. If that were to occur, habitat may improve in 25 – 50 years for moonworts.

DIRECT AND INDIRECT EFFECTS COMMON TO BOTH ACTION ALTERNATIVES

Untreated portions of the project area would be on an ecological pathway essentially the same as in the No Action Alternative. The difference between the action alternatives is a matter of degree, with greater impacts from the proposed action than the other action alternative.

Timber operations can cause light to moderate ground disturbances and soil removal. Timber operations would disturb or compact soils in the areas where skid trails and temporary roads are used. It is anticipated that this could account for as much as 15 percent of the landscape in the salvage area. This could dislodge herbaceous plants and break stems of shrubs where the actions occur. The amount of disturbance to the soils and plants would vary considerably. Areas at the distant ends of skid trails would receive the least damage, while log landings would receive the most. Plants in the less disturbed sites would less likely to be severely damaged because the degree of initial disturbance was lower. These plants would then be able to recover quickly. Where there are more disturbances, plants that would be naturally recovering would receive additional stress, and some may not survive. In these areas, the potential of noxious weed encroachment is greater. Shade is removed from sites altering habitat conditions for plants.

Noxious weed invasion potentially poses a negative impact to all plant habitats. These potential effects result from removal of vegetation and opening up the area to additional light. Weed infestation following a burn has the potential to extirpate populations of uncommon plants. Noxious weeds, once established, could indirectly impact sensitive plant species through allelopathy (the production and release of plant compounds that inhibit the growth of other plants), changing the fire regime, or direct competition for nutrients, light, or water. Subsequent weed control efforts could also negatively impact sensitive plants.

Federally Listed Endangered and Threatened Species

There are no known occurrences of federally listed threatened, endangered, or proposed plant species in the proposed project area. There is also no known habitat, including proposed or designated critical habitat, for any of these species in the proposed project area. For these reasons, there will be no effect to any federally listed threatened, endangered, or proposed species. The action will not destroy or adversely modify any proposed or designated critical habitat.

Because there are no known occurrences of, and no habitat for, Penland's alpine fen mustard or diluvium ladies' tresses in or near the project area, the proposed project will have no effect (direct, indirect, or cumulative) on these species.

Regional Forester's Sensitive Species

The majority of the treatments would take place in older lodgepole pine stands. These sites generally do not have the recent (25 – 50 years) disturbances to provide habitat for moonworts and are typically drier than habitats required for Weber's draba and Selkirk's violet. Impacts are more likely to occur where existing road edges may be disturbed during project implementation, or where streamside habitat would be disturbed.

Any undiscovered populations of RFSS in the area would recover along with the remainder of the community, although up to 15 percent of the area would be subjected to potential soil disturbance from timber salvage activities. Within areas of activity, individuals could be injured or stressed through soil disturbance and compaction from heavy equipment.

Impacts of this proposed project were assessed as they pertain to the RFSS present in the project area. It was determined that the proposed project may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing or a loss of species viability rangewide.

Climate Change _____

Complete quantifiable information about project effects on global change is not currently possible. However, based on climate change science, there is potential for some types of projects to affect or influence climate change (USDA 2009). It is not currently feasible to quantify indirect effects of this project on global climate change because the size of the project is extremely small in the context of climate change. Although it is possible to quantify a project's direct effects on carbon sequestration and greenhouse gas emissions, there is no certainty about the actual intensity of a project's indirect effects on climate change. Uncertainty in climate change effects is expected because it is not possible to meaningfully link individual project actions to quantitative effects on climate patterns.

There would be no effect to climate change under the No Action Alternative. Prescribed fire activities proposed in Alternative 1 and 2 would result in an initial direct release of carbon dioxide during burning operations. Prescribed fire activities would occur on up to 6,040 acres and be spread over multiple years. Burning operations would adhere to air quality standards and this activity would not contribute to climate change either regionally or globally. All activities proposed under Alternative 1 and 2 would reduce future wildfire risk in the treatment areas which reduces the risk of emissions from future wildfires. Regeneration of lodgepole pine stands would serve to sequester carbon dioxide from the air. Given past, present and reasonable foreseeable future activities, Alternative 1 and 2 would not contribute measureable cumulative effects on climate change.

Specifically Required Disclosures ---

ENVIRONMENTAL JUSTICE

Environmental Justice provides that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner, by government programs and activities affecting human health or the environment.

Civil Rights would not be affected by the Tennessee Creek Project. The project includes purchaser work, Forest Service contracted work, and Forest Service employee accomplished work (Force Account). Under Executive Order 11246 companies with Federal contracts or subcontracts are prohibited from job discrimination on the basis of race, color, religion, gender or national origin. The U. S. Department of Agriculture prohibits discrimination in its employment practices based on race, color, National origin, gender, religion, age, disability, political beliefs, sexual orientation and marital and family status.

Executive Order 12898 (59 Fed. Reg. 7629, 1994) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Minority and poor communities adjacent to the project area include several Hispanic communities located in the Leadville near the project boundaries. Many Hispanics in the area hold lower paying jobs in the service and ski industries.

The effects of the proposed action on civil rights and low income or minority communities would be minimal. Employment would be created through both timber sale and service contracts, and contractors/subcontractors are prohibited from discrimination based on race, color, religion, gender, or national origin. Some contracts for this project may be offered under Small Business Administration authorities, which could result in positive employment benefits to minority populations.

This project does not have the potential to disproportionately adversely affect minority or low income populations and would not affect civil liberties.

The proposed action would not have any disparate effects on any consumers, minority groups, women, civil rights, or social/ethnic groups. All contracts would meet Equal Employment Opportunity requirements. The United States Department of Agriculture prohibits discrimination in

its programs based on race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status.

EFFECTS ON PRIME FARMLAND, RANGELAND, AND FOREST LAND

The proposed action complies with the Secretary of Agriculture's Memorandum 1827 for prime land. The forest land within the project area does not qualify as "prime forests because growth rates do not exceed 85 cubic feet per year at culmination of mean annual increment." Effects to forest land are described earlier in this chapter. The Tennessee Creek project area does not contain any prime rangeland or prime farmland. Therefore, none of the alternatives would have any effect on prime rangeland or farmland.

WILD AND SCENIC RIVERS

No Wild or Scenic rivers are located within the project area.

CHAPTER 4 – CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

ID TEAM MEMBERS:

Lisa Corbin	Team Leader
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Neal Weierbach	Landscape Architect
Mike Welker	Fisheries
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Jeni Windorski	Wildlife
Tami Conner	District Ranger

FEDERAL, STATE, AND LOCAL AGENCIES:

U. S. Fish and Wildlife Service
Colorado Parks and Wildlife
Colorado State Historic Preservation Office
Colorado State Forest Service

TRIBES:

Ute Mountain Ute Tribe
Southern Ute Indian Tribe
Jicarilla Apache Nation
Ute Indian Tribe (Uintah and Ouray Reservations)

OTHERS:

Lake County Board of County Commissioners
Lake County Emergency Service Council

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GLOSSARY

Basal area – The cross-sectional area of the stems of plants in a stand. Herbaceous and small woody plants are measured at diameter at root collar (DRC) or near ground level; larger woody plants are measured at diameter at breast height (DBH) or other appropriate height. Basal area is a way to measure how much of a site is occupied by plants.

Best management practices (BMPs) - Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters [40 CFR 130.2(m)].

Class I Federal area – Class 1 federal lands include areas such as national parks, national wilderness areas, and national monuments. These areas are granted special air quality protections under Section 162(a) of the federal Clean Air Act.

Coarse woody debris – Coarse woody debris is typically defined as dead standing and downed wood pieces larger than 3 inches in diameter (Harmon and others 1986).

Communities-at-risk – As identified in the Federal Register, high risk urban communities within the wildland-urban interface.

Critical habitat – When a species is listed as endangered or threatened under the Endangered Species Act (ESA), it is protected which includes protection of the habitat it occupies. In addition, specific areas may be designated as particularly necessary for the species' recovery whether the species is present or not; these areas are called "critical habitat." Besides requiring federal agencies to ensure that their actions will not jeopardize the survival of an endangered or threatened species itself, the ESA also requires that their actions not destroy or adversely modify designated critical habitat.

Dead tree – Trees with 100% red, brown or no needles.

Developed recreation site – A distinctly defined area where facilities are provided by the Forest Service for concentrated public use (e.g., campgrounds, picnic areas, and swimming areas).

Diameter – The diameter of a tree species, usually measured by two primary methods:

Diameter at breast height (DBH) – The diameter of a forest tree species at the bole (or trunk) typically measured at 4.5 feet above ground level.

Dispersed recreation – Outdoor recreation in which visitors are spread over relatively large areas. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the visitors.

Even-aged stands – Forests that are composed of one or two distinct age classes of trees.

Even-aged management – The application of a combination of actions that result in the creation of stands in which trees are essentially the same age. Managed even-aged forests are characterized by a distribution of stands of varying ages (and therefore, tree size). Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Fire regime – The patterns, frequency, and severity of fire that occur over a long period of time across a landscape and its immediate effects on the ecosystem. There are five fire regimes which are classified based on frequency (average number of years between fires) and fire severity (amount of replacement of the dominant overstory vegetation). These five regimes are:

Fire regime I – 0 to 35 year frequency and low (surface fires most common, isolated torching can occur) to mixed severity (less than 75 percent of dominant overstory vegetation replaced)

Fire regime II – 0 to 35 year frequency and high severity (greater than 75 percent of dominant overstory vegetation replaced)

Fire regime III – 35 to 100+ year frequency and mixed severity

Fire regime IV – 35 to 100+ year frequency and high severity

Fire regime V – 200+ year frequency and high severity.

Fire severity – Degree to which a site has been altered or disrupted by fire; also used to describe the product of fire intensity and residence time; usually defined by the degree of soil heating or mortality of vegetation.

Hiding Cover – Cover that hides 90% of an adult standing deer or elk from human view at a distance at 200 feet from the road.

Historical Range of Variability (HRV) – The variability of regional or landscape composition, structure, and disturbances, during a period of time of several cycles of the common disturbance intervals, and similar environmental gradients, referring, for the United States, to a period prior to extensive agricultural or industrial development.

Horizontal cover – The visual obscurity provided by vegetation that extends to the ground or snow surface, primarily provided by trees stems and tree boughs, but may also be provided by shrubs, herbaceous vegetation, and landscape topography (from the Southern Rockies Lynx Amendment).

Hydrologic Function – The behavioral characteristics of a watershed described in terms of ability to sustain favorable conditions of water flow. Favorable conditions of water flow are defined in terms of water quality, quantity, and timing.

Kettle hole – Located in depressions on the lateral moraines left by blocks of ice buried in the morainal rubble. Sites either previously or presently contain water.

Litter – Litter consists of dead, unattached organic material on the soil surface that is effective in protecting the soil surface from raindrop splash, sheet, and rill erosion and is at least ½ inch thick. Litter is composed of leaves, needles, cones, and woody vegetative debris including twigs, branches, and trunks.

Mosaic – Pattern of patches, corridors, and matrix (forest or non-forest) that form a landscape in its entirety.

National Forest System (NFS) – As defined in the Forest Rangeland Renewable Resources Planning Act, the “National Forest System” includes all national forest lands reserved or withdrawn from the public domain of the United States, all national forest lands acquired through purchase, exchange, donation, or other means; the National Grasslands and land use projects administered under Title III of the Bankhead-Jones Farm Tennant Act (50 Stat. 525, 7 U.S.C. 1010-1012); and other lands, waters,

or interests therein administered by the Forest Service or are designated for administration through the Forest Service as part of the system.

National Forest System Road – A road wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the NFS and the use and development of its resources. A forest road other than a road which has been authorized by a legally documented right-of-way held by a state, county, or other local public road authority. (36 CFR 212.1)

Natural fire regime – The fire regime that existed prior to human-facilitated interruption of frequency, extent, or severity.

Natural Range of Variability (NRV) – The ecological conditions and processes within a specified area, period of time, and climate, and the variation in these conditions, that would occur without substantial influence from human mechanisms.

Natural river restoration techniques - The use of materials indigenous to the ecosystem (e.g., trees, boulders, root wads, sedge mats) to restore a stream system's ability to approach a pre-disturbance condition.

Openings – Spatial breaks between groups or patches of trees, as large or larger than groups, that contain grass, forb, shrub, and/or tree seedlings but are largely devoid of big trees, with a total tree cover of less than ten percent in openings.

Proper functioning condition (PFC) – ecosystems at any temporal or spatial scale are in a proper functioning condition when they are dynamic and resilient to disturbances to structure, composition, and processes of their biological or physical components. To have sustainable conditions, a landscape should contain a balance of vegetative structural stages, vegetative seral states, and species that are characteristic of the landscape during a defined historical period.

Reforestation – The natural or artificial restocking of an area with forest trees.

Riparian area – Terrestrial ecosystems characterized by wet soils and plant species that are water loving and dependent on the water table or its capillary fringe zone (a zone in the soil just above the water table that remains saturated or almost saturated).

Seral state – A particular plant and animal community developmental stage which is transitional between other stages along the continuum of succession or change. Changes in seral states can take place over time or very quickly and movement between states can be in either direction. Aspen is an example of a seral state that, without disturbance over time, will eventually be replaced by a subsequent seral state dominated by conifers.

Silviculture – The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

Slash – the residue (e.g., branches, bark) left on the ground after a management activity, such as logging, or natural ecological process such as a storm or fire.

Snags – Standing dead or partially dead trees (snag-topped), often missing many or all limbs and/or bark. Generally, larger snags provide essential wildlife habitat for many species and are important for forest ecosystem function.

Soft snags – Rotten, decay class 3 – 5.

Soil productivity – The inherent capacity of the soil to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses.

Stand – A contiguous group of trees generally uniform in age class distribution, composition, condition, and structure, and growing on a site of generally uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silvicultural reporting and record-keeping.

Temporary road or trail – A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas. (36 CFR 212.1)

Thinning – A treatment to reduce the density of trees primarily to improve growth, enhance forest health, to recover potential mortality, or to emphasize desired tree species. Includes crown thinning (thinning from above, high thinning), free thinning, low thinning (thinning from below), mechanical thinning (geometric thinning), and selection thinning (dominant thinning). Thinning can be used with both even and uneven-aged management systems.

Traditional Cultural Property – Is defined in the National Register Bulletin 38 as a location, building, structure, community, and individual objects that are considered eligible for inclusion in the National Register as a historic property because of its association with cultural practices or beliefs of a living community that are (a) rooted in that community's history and (b) important in maintaining the continuing cultural identity of the community. Traditional Cultural properties (TCPs) are places of cultural and religious significance to many Native American tribes.

Tree cutting – The cutting or removal of trees for wood fiber use and other multiple-use purposes. Sometimes referred to as “timber harvest.”

Uneven-aged stands – Stands that are composed of three or more distinct age classes of trees, either inter-mixed or in small groups.

Uneven-aged management – The application of combined actions needed to simultaneously maintain continuous forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Visual Quality Objectives (VQOs) – An assessment of the relative visual resource quality on the forest as it relates to potential resource use and/or development. Management direction is provided in the forest plan by identifying five VQOs across the forest which include:

Preservation (P): Applies to wilderness areas, primitive areas, other specially classified areas. This VQO only allows ecological changes to the landscape and most management activities, except for very low visual-impact recreation facilities, are prohibited.

Retention (R): Provides for management activities which are not visually evident and may only repeat form, line, color, and textures common in the landscape. Changes in size, amount, intensity, direction, pattern, should not be evident.

Partial Retention (PR): Management activities are visually evident but subordinate to the landscape. Activities may repeat form, line, color, or texture common to the landscape but changes in their qualities of size, amount, intensity, direction, pattern, remain visually subordinate to the overall landscape.

Modification (M): Management activities may visually dominate the landscape. However, activities of vegetative and land form alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that the visual characteristics are those of natural occurrences within the surrounding area or character type.

Maximum Modification (MM): Similar to modification management requirements, but alterations may be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground.

Water influence zone (WIZ) – Area including the geomorphic floodplain, riparian ecosystem, and inner gorge. It includes adjacent unstable and highly-erodible soils. The WIZ protects interacting aquatic, riparian, and upland functions by maintaining natural processes and resilience of soil, water, and vegetation systems.

Wildland-urban interface (WUI) – Wildland-urban interface includes those areas of resident populations at imminent risk from wildfire and human developments having special significance. These areas may include: critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that, if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

Wind throw – Trees susceptible to wind damage (i.e., breakage, toppling).

Woody biomass – The trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or grassland environment, that are the by-products of forest management used to produce bio-energy and the full range of bio-based products.

APPENDIX A – LAW AND REGULATION

Natural resource management on National Forest System lands is based on several Federal and State laws and regulations. The following table displays some of the laws and regulations pertinent to the Tennessee Creek Project.

LAWS AND REGULATIONS CONSISTENT WITH THE TENNESSEE CREEK PROJECT

Table A.1 Pertinent Laws and Regulations

Laws and regulations	Description	Authority
Organic Administration Act (1897)	Provides basic authority for watershed management.	USDA
Multiple-Use Sustained Yield Act of 1960 (MUSYA)	National forests are to be administered for recreation, range, timber, watershed, wildlife, fish, and to develop renewable surface resources.	Secretary of Agriculture
National Environmental Policy Act of 1969 (NEPA)	Established procedures for decision making, disclosure of effects, and public involvement on all major federal actions.	All agencies
National Forest Management Act of 1976 (NFMA)	Requires development of land and resource management plans and governs administration on national forests.	Secretary of Agriculture
Noxious Weed Act, 1974 as amended	Directs Federal agencies to coordinate with state and local governments to contain and control undesirable plant species by entering into Memorandums of Understanding and other agreements where appropriate and to develop policy direction.	All agencies
Forest and Rangeland Renewable Resource Planning Act of 1974	Authorizes long-range planning to ensure the future supply of forest resources while maintaining a quality environment.	Secretary of Agriculture
Federal Land Policy and Management Act of 1976	Public lands to be managed to preserve and protect certain lands in their natural condition.	Secretary of Agriculture
Rescission Act of 1995	Requires NEPA analysis on grazing allotments.	Secretary of Agriculture
Clean Water Act, 1977, 1982 as amended	Restore and maintain integrity of surface waters by eliminating pollutant discharge into water and achieve water quality levels to be fishable and swimmable.	U. S. Environmental Protection Agency, U. S. Army Corps of Engineers
Wild and Scenic Rivers Act, 1968 as amended	System for designating wild and scenic rivers.	All agencies
Endangered Species Act, as	Section 7 governs conservation of ecosystems and	U. S. Fish and

amended 1973	populations of threatened and endangered plant and animal species.	Wildlife Service (USFWS)
Migratory Bird Treaty Act, 1918 and Executive Order 13186, 2001	Protection of migratory birds, nests, and eggs. E. O. requires environmental analysis of actions on migratory bird species of concern.	USFWS
Bald and Golden Eagle Protection Act, 1940	Protection of Bald and Golden Eagles.	All agencies
National Trails System Act, 1968	Establishes a national system of recreation, scenic, and historic trails.	All agencies
National Historic Preservation Act, 1966, 1976, 1980, 1992 as amended	Section 106 governs treatment of cultural resources during project planning and implementation.	All agencies
Archaeological Resources Protection Act of 1979	Cultural resources.	All agencies
Archeological Historic Preservation Act of 1974	Cultural resources.	All agencies
American Indian Religious Freedom Act 1978	Considers impacts of actions on tribal cultural practices.	All agencies
Executive Order 13112, 1999	Directs Federal agencies to prevent introduction and spread of invasive species, to cooperate with a newly created Invasive Species Council, and to produce and follow direction given in an Invasive Species Management Plan.	All agencies
Executive Order 13443	Governs expansion and enhancement of hunting opportunities and management of game species and habitats.	All agencies
Executive Order 11988	To avoid to the extent possible the long and short term impacts associated with the occupancy and modification of floodplains.	All agencies
Executive Order 11990, 1977	Protect wetlands from destruction or modification.	All agencies
Executive Orders 11593 (1971), 13007 (1996), 13175 (2000)	Protection of cultural resources, Indian sacred sites, consultation and coordination with Indian Tribal governments.	All agencies
Executive Order 12898 (1994) and 13045	Environmental justice for environmental health conditions in minority and low-income communities and children	All agencies

National Fire Plan (2001)	Addresses five key points: Firefighting; Rehabilitation and Restoration; Hazardous Fuel Reduction; Community Assistance; and Accountability. The Forest Service and BLM have developed comprehensive strategies in response to the national fire plan, for protecting people and the environment by restoring and sustaining land health.	USDA and USDI
Executive Order 13195	Protect, connect, promote, and assist trails of all types through the United States.	All agencies
1985 Continental Divide National Scenic Trail (CDNST) Comprehensive Plan amendment (2009)	Provides direction to guide the development and management of the CDNST	Chief of the Forest Service
Colorado Air Quality Control Commission, Regulation 9	Provides direction and guidance related to smoke management within the State of Colorado. A permit for burning is required for prescribed burns within the State of Colorado.	Dept. of Health and Environment, Colo. Air Quality Control Commission
Pike and San Isabel National Forests, Comanche and Cimarron National Grasslands Land and Resource Management Plan (1984)	Provides standards and guidelines for management and monitoring of actions across the National Forest.	Secretary of Agriculture
White River National Forest Land and Resource Management Plan 2002 Revision	Provides standards and guidelines for management and monitoring of actions across the National Forest.	Secretary of Agriculture
Environmental Assessment for the Management of Noxious Weeds (1998); Biological Assessment for Management of Noxious Weeds (2013)	Environmental Analysis for the Implementation of the Forest wide noxious weed management program which authorizes chemical treatment of invasive plants on the forests.	Pike & San Isabel National Forests
Southern Rockies Lynx Amendment Record of Decision (2008)	Amends the 1984 Forest Plan; provides consistent management direction that will conserve the Canada lynx.	Forest Service, Rocky Mountain Region
Canada Lynx Conservation Assessment and Strategy	Provide consistent and effective approach to conserve Canada lynx on federal lands	USDA, USDI

APPENDIX B – SOUTHERN ROCKIES LYNX AMENDMENT (SRLA) ANALYSIS

This analysis for Canada lynx is based on the new Pike/San Isabel Lynx Habitat Map submitted to USFWS for concurrence in December of 2013. The map uses the best scientific available information as well as the latest advances in modeling and mapping of habitat. In general, for the Leadville Ranger District and this project area, climax dry lodgepole is no longer mapped as lynx habitat and LAU sizes were shrunk to extents recommended by the Lynx Conservation Assessment and Strategy, providing for a more conservative approach when considering treatment thresholds. All SRLA standards, guides, “currently unsuitable” thresholds, etc., would still be met for this project if it had been analyzed under the old map.

STANDARDS AND GUIDES APPLICABLE TO ALTERNATIVE 1 (PROPOSED ACTION)

The SRLA describes several objectives, standards, and guidelines intended to conserve lynx and to reduce or eliminate adverse effects from a spectrum of management activities on federal lands. These measures are provided to assist federal agencies in seeking opportunities to benefit lynx and to help avoid negative impacts. The PSICC as well as other National Forests in Region 2 have adopted the SRLA (Forest Service 2008) as a consistent and effective approach for lynx conservation. The following section below addresses SRLA compliance with the proposed action.

Objective VEG 01

Manage vegetation to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx.

Met. The project is designed to create more age classes and species diversity to break up the unnatural succession of a monoculture of lodgepole, created during the mining boom in the late 1880’s and early 1900’s. Lynx habitat has been identified and project design allows for retention of high quality habitat and enhancement of low-quality foraging areas.

Objective VEG 02

Provide a mosaic of habitat conditions through time that support dense horizontal cover, and high densities of snowshoe hare. Provide winter snowshoe hare habitat in both the stand initiation structural stage and in mature, multi-story conifer vegetation.

Met. The Tennessee Creek project will preserve high quality snowshoe hare habitat (stands with greater than 35 percent dense horizontal cover) that currently exists. Low quality foraging habitat will be converted to the stand initiation structural stage while maintaining or enhancing adjacent areas with mature, multi-storied characteristics.

Objective VEG 04

Focus vegetation management in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover.

Met. Areas consisting of climax lodgepole pine (little to no dense horizontal cover or snowshoe hare habitat) will be targeted for clear-cutting activities. Other areas with low horizontal cover will also be targeted for treatment, either clear-cutting or thinning in an uneven age management style to promote multi-storied stands. Any stands with high (greater

than 35 percent) horizontal cover will be retained as quality snowshoe hare habitat and will not receive treatment.

Standard VEG 01

If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.

Met. Currently there are no acres of lynx habitat within the stand initiation stage, mapped as “currently unsuitable”, in the Tennessee Pass and Massive LAUs respectively. Full implementation of The Tennessee Creek Project would put the percent of lynx habitat in the stand initiation stage in the Tennessee Pass LAU and the Massive LAUs at 6 percent for each. Should a large epidemic (insect and disease, blowdown, etc.) commence and put these LAUs over this 30 percent threshold, timber harvesting activities associated with this project that regenerate stands would cease and would not be implemented.

Standard VEG 02

Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands within and LAU in a ten-year period. This 15 percent includes the entire stand within an even-age regeneration area, and only the patch opening areas within group sections. Salvage harvest within stands killed by insect epidemics, wildfire, etc. does not add to the 15 percent, unless the harvest treatment would cause the lynx habitat to change to an unsuitable condition.

Met. The acres proposed for clear-cutting are at a maximum 1,158 and 1,327 acres for the Tennessee Pass LAU and the Massive LAU. This would put the percent of stands in initiation structural stage for each LAU at 6 percent. There are no stands currently in this state. Smaller patch cuts (up to 5 acres) within stands proposed for thinning would also count toward this threshold and would be recorded and tracked appropriately as such.

Standard VEG S5

Pre-commercial thinning practices and similar activities intended to reduce seedling/sapling density are subject to the following limitations from the stand initiation structural stage until the stands no longer provide winter snowshoe hare habitat. Pre-commercial thinning may occur only (VEG S5 Exceptions): Exceptions 3 and 5 below only apply to this project:

3. For conifer removal in aspen, or daylight thinning, around individual aspen trees, where aspen is in decline;

5. Pre-commercial thinning may occur provided that:

- a. The additional pre-commercial thinning does not exceed 1 percent of the lynx habitat in any LAU for the life of this amendment, and the amount and distribution of winter snowshoe hare habitat within the LAU must be provided through appropriate site-specific analysis and consultation; and**
- b. Pre-commercial thinning in LAUs with more than 30 percent of the lynx habitat currently in the stand initiation structural stage is limited to areas that do not yet provide winter snowshoe hare habitat; and**
- c. Projects are designed to maintain lynx habitat connectivity and provide snowshoe hare habitat over the long term; and**
- d. Monitoring is used to determine snowshoe hare response.**

Met. Only 345 acres total throughout the 16,450 acre project area are proposed for pre-commercial thinning, 40 acres in the Tennessee Pass LAU and 305 acres in the Massive LAU.

However, many stands proposed for pre-commercial thinning in the Massive LAU are not within lynx habitat and would not contribute to the 1 percent threshold. Approximately 31 acres in the Massive LAU are in lynx habitat and all 34 acres in the Tennessee Pass LAU are in lynx habitat. This constitutes 0.1 percent and 0.2 percent of the lynx habitat in the Massive LAU and Tennessee Pass LAU. Neither LAU has more than 30 percent of lynx habitat currently in the stand initiation stage. In fact, no stands are in the stand initiation stage. The nature of implementation of the Tennessee Creek Project provides for snowshoe hare habitat over the long term as treatments are spread out on a landscape scale and will be implemented intermittently over the next 10 years. Reserve areas between clear cuts will provide covered travel corridors and higher quality stands for foraging (stands with greater than 35 percent dense horizontal cover) would also remain on the landscape providing foraging and movement areas. Thinning would be at variable levels throughout the stand creating mosaics of thinned and unthinned areas. Monitoring would take place prior to and following implementation to determine snowshoe hare response. Pellet plots in these stands could be used as a monitoring technique. (Note: The previously consulted on project “Leadville Timber Stand Improvement Project” in 2012 was never implemented and the acres for that project are included in this proposal.)

Standard VEG S6

Vegetation management projects that reduce winter snowshoe hare habitat in multi-story mature or late successional conifer forests may occur only (VEG S6 Exceptions): Exceptions 3 and 4 below are the only ones that apply to this project:

- 3. For incidental removal during salvage harvest (e.g., removal due to location of skid trails); or**
- 4. Where uneven-aged management (single tree and small group selection) practices are employed to maintain and encourage multi-story attributes as part of gap dynamics. Project design must be consistent with VEG 01 and 02, except where impacts to areas of dense horizontal cover are incidental to activities under this exception (e.g., construction of ski trails).**

Met. Salvage harvest will only be implemented should the need arise; currently the conditions on the landscape do not warrant salvage treatments, but this project is designed to allow for it should the need arise. The intent and design of this project is to create a diversity of age classes and species diversity on a landscape scale. Preference would be given to retaining other species (spruce, fir, aspen) over lodgepole pine and spacing would be variable. Trees would be thinned in a manner to create clumps or cohorts of trees intermingled with small, irregular openings or areas of lower tree density. Approximately 7,110 acres of the project area (16,450 acres) would be thinned in this manner. Prescribed fire would be used to create a mosaic of openings and variable densities of cover, mimicking natural disturbances. This uneven-aged management style is consistent with Exemption 4 of this standard and acres are not limited under this standard.

Guideline VEG G1

Vegetation management projects should be planned to recruit a high density of conifers, hardwoods, and shrubs where such habitat is scarce or not available. Priority for treatment should be given to stem-exclusion, closed-canopy structural stage stands to enhance habitat conditions for lynx or their prey (e.g. mesic, monotypic lodgepole stands). Winter snowshoe hare habitat should be near denning habitat.

Met. The intent of this project is in line with this guideline as the goal of the Tennessee Creek Project is to create more age class diversity as well as species diversity in a

monoculture of mature lodgepole pine stands. Climax lodgepole stands will be targeted for treatments that regenerate young trees and spruce, fir, and aspen will have preference over lodgepole in areas that are to be thinned, providing for the opportunity for increased horizontal cover and higher quality lynx habitat in the long-term (50+ years).

Guideline VEG G4

Prescribed fire activities should not create permanent travel routes that facilitate snow compaction. Constructing permanent firebreaks on ridges or saddles should be avoided.

Met. Every effort would be made to prevent any temporary routes from becoming a regularly used route by the public. This would be accomplished by restricting the public from using any temporarily created roads by using boulders, gates, etc., or any other means necessary to restrict access. Roads would be permanently closed immediately after the final treatment is complete (sometimes there is a year or two between mechanical treatment completion and prescribed burning). The road would be closed appropriately and should not facilitate any addition to snow compaction.

Guideline VEG G5

Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU.

Met. Design criteria provide for retainment of snags and coarse woody debris within treated stands. There will be reserve areas in which no treatments would take place, ensuring adequate mature trees and stands are available for red squirrels. These reserves would provide canopy cover and coarse woody debris for squirrels and middens and surrounding clumps would be retained as well.

Guideline VEG G11

Denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris, either downed logs or root wads, or large piles of small wind thrown trees ("jack-strawed" piles). If denning habitat appears to be lacking in the LAU, then projects should be designed to retain some coarse woody debris, piles, or residual trees to provide denning habitat in the future.

Met. In the event that a spruce-fir salvage harvest would be needed due to insect and disease, windthrow, etc., 10 percent (150 acres) of the total available spruce-fir in the project area would not be salvaged. These reserve areas would be identified by and coordinated with the Wildlife Biologist to ensure the best possible future denning habitat is retained (areas near high quality foraging habitat, stands on north or east aspects etc.). These retained trees would eventually fall and become lynx denning habitat. These preferably would be retained in 5 acre patches or more. If there is no need for spruce-fir salvage, the reserve areas would include areas of large piles of wood, etc. if available on the landscape.

Guideline HU G9

If project level analysis determines that new roads adversely affect lynx, then public motorized use should be restricted. Upon project completion, these roads should be reclaimed or decommissioned, if not needed for other management objectives.

Met. The timber personnel have estimated that approximately 21 miles of temporary roads would be needed in order to access the harvest sites. As mentioned above, all access would be restricted to the public through appropriate means (gates, etc.) and roads would be

decommissioned or closed immediately following final treatment. Roads will remain gated between implementation phases to allow for fuels to cure, burn windows to align, and final implementation to be complete before closing the temporary road.

Objective ALL O1

Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.

Met. Connectivity would be maintained in and between the Tennessee Pass and Massive LAUs and throughout the Tennessee Pass Linkage area. Implementation is designed to take place intermittently over the next 10 years with treatment spread throughout the entire project area. No one location would be impacted at one time to the scale and degree that would prohibit lynx movement on the landscape. Clear cut areas would be limited to 40 acre patches reserve areas would remain to ensure movement through the linkage area would not be compromised. Forested areas with high quality lynx habitat (multi-storied lodgepole/spruce/fir with greater than 35 percent dense horizontal cover) would not be treated and would provide security and movement corridors.

Because this project (1) does not create new highways, ski areas, or new private land development (the three major things identified as hindering connectivity), (2) there is sufficient amounts of suitable habitat left on the landscape providing connectivity as suggested by the SRLA, (3) there are no treatments in high quality lynx habitat (spruce-fir and any stands with >35% DHC), and (4) treated areas (located in lower quality lynx habitat; seral lodgepole pine stands) provide a mosaic of gaps, dense areas, openings, thinned areas, and reserves; this project will maintain connectivity on the landscape as well as within the linkage area.

Standard ALL S1

New or expanded permanent developments and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage areas.

Met. See Objective ALL O1 above.

STANDARDS AND GUIDES APPLICABLE TO ALTERNATIVE 2

Note: All standards and guides applicable to Alternative 1 (Objectives VEG 01, VEG 02, VEG 04 and ALL 01; Standards VEG S1, VEG S2, VEG S5, VEG S6 and ALL S1; and Guidelines VEG G1, VEG G4, VEG G5, VEG G11 and HU G9) also apply to Alternative 2 and are in compliance with SRLA with the same reasoning. The only differences are highlighted below and are attributed to acreage and percentage changes. See all standards and guides listed above for Alternative 1 for they all apply here as well.

Standard VEG 01

If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.

Met. Currently there are no acres of lynx habitat within the stand initiation stage, mapped as "currently unsuitable", in the Tennessee Pass and Massive LAUs respectively. Full implementation of the Tennessee Creek Project Alternative 2 would put the percent of lynx habitat in the stand initiation stage in the Tennessee Pass LAU and the Massive LAUs at 9 percent and 10 percent respectively. Should a large epidemic (insect and disease,

blowdown, etc.) commence and put these LAUs over this 30 percent threshold, timber harvesting activities associated with this project that regenerate stands would cease.

Standard VEG 02

Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands within and LAU in a ten-year period. This 15 percent includes the entire stand within an even-age regeneration area, and only the patch opening areas within group sections. Salvage harvest within stands killed by insect epidemics, wildfire, etc. does not add to the 15 percent, unless the harvest treatment would case the lynx habitat to change to an unsuitable condition.

Met. The acres proposed for clear-cutting are 1,850 acres and 2,120 acres for the Tennessee Pass LAU and the Massive LAU. This would put the percent of stands in initiation structural stage at 9 percent and 10 percent respectively. Smaller patch cuts (up to 5 acres) within stands proposed for thinning would also count toward this threshold and would be recorded and tracked appropriately as such.

Standard VEG S6

Vegetation management projects that reduce winter snowshoe hare habitat in multi-story mature or late successional conifer forests may occur only (VEG S6 Exceptions): Exceptions 3 and 4 below are the only ones that apply to this project:

- 3. For incidental removal during salvage harvest (e.g., removal due to location of skid trails); or**
- 4. Where uneven-aged management (single tree and small group selection) practices are employed to maintain and encourage multi-story attributes as part of gap dynamics. Project design must be consistent with VEG 01 and 02, except where impacts to areas of dense horizontal cover are incidental to activities under this exception (e.g., construction of ski trails).**

Met. Salvage harvest will only be implemented should the need arise; currently the conditions on the landscape do not warrant salvage treatments, but this project is designed to allow for it should the need arise. The intent and design of this project is to create a diversity of age classes and species diversity on a landscape scale. Preference would be given to retaining other species (spruce, fir, aspen) over lodgepole pine and spacing would be variable. Trees would be thinned in a manner to create clumps or cohorts of trees intermingled with small, irregular openings or areas of lower tree density. Approximately 3,030 acres of the project area (16,450 acres) would be thinned in this manner. Prescribed fire would be used to create a mosaic of openings and variable densities of cover, mimic natural disturbances. This uneven-aged management style is consistent with Exemption 4 of this standard and acres are not limited under this standard.

Objective ALL O1

Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.

Met. Connectivity would be maintained in and between the Tennessee Pass and Massive LAUs and throughout the Tennessee Pass Linkage area. Implementation is designed to take place intermittently over the next 10 years with treatment spread throughout the entire project area. No one location would be impacted at one time to the scale and degree that would prohibit lynx movement on the landscape. Clear cut areas would be limited to 40 acre patches and reserve areas would ensure movement through the linkage area would not be compromised. Forested areas with high quality lynx habitat (multi-storied lodgepole/spruce/fir with greater than 35 percent dense horizontal cover) would not be treated and would provide security and movement corridors.

Because this project (1) does not create new highways, ski areas, or new private land development (the three major things identified as hindering connectivity), (2) there is sufficient amounts of suitable habitat left on the landscape providing connectivity as suggested by the SRLA, (3) there are no treatments in high quality lynx habitat (spruce-fir and any stands with >35% DHC), and (4) treated areas (located in lower quality lynx habitat; seral lodgepole pine stands) provide a mosaic of gaps, dense areas, openings, thinned areas, and reserves; this project will maintain connectivity on the landscape as well as within the linkage area.

APPENDIX C – CANDIDATE/PROPOSED, FOREST SENSITIVE AND MANAGEMENT INDICATOR SPECIES WITH POTENTIAL TO OCCUR WITHIN THE ANALYSIS AREA

SPECIES COMMON AND SCIENTIFIC NAME	STATUS ¹	POTENTIAL TO OCCUR?	RATIONALE FOR EXCLUSION ²	BRIEF HABITAT DESCRIPTION AND RANGE IN COLORADO
INVERTEBRATES				
Susan's purse making caddis fly <i>Ochrotrichia susanae</i>	S		ODR	springs and seeps found in Chaffee and Park Counties
Hudsonian emerald <i>Somatochlora hudsonica</i>	S		ODR	seven known locations in Colorado, all within a 40-mile radius of Boulder. Boggy wetlands, springs, & ponds with muddy bottoms are potential breeding sites
Rocky mountain capshell snail <i>Acroloxus coloradensis</i>	S		ODR	littoral zone of oligotrophic and mesotrophic mountain lakes with neutral to slightly alkaline water and high dissolved oxygen content; 8,800-9,800 ft.
Nokomis fritillary butterfly <i>Speyeria Nokomis fritillary</i>	S		ODR	Permanent spring-fed wetlands/soggy soils & shade supporting bog violet (<i>Viola nephrophylla</i>) in arid environments <7500' elevation, butterfly & host plant not known to occur in Eagle or Lake county.
AMPHIBIANS AND REPTILES				
Boreal toad (western toad) <i>Anaxyrus boreas boreas</i>	S	X		breeds in ponds & over winter in refugia within lodgepole pine, spruce-fir forests, & alpine meadows; 7,500-12,000 ft.
Northern leopard frog <i>Lithobates pipiens</i>	S	X		banks & shallow portions of marshes, ponds, lakes, reservoirs, beaver ponds & streams, especially those with rooted aquatic vegetation up to 11,000 ft.
Plains leopard frog <i>Lithobates blairi</i>	S		ELE	margins of streams, natural and artificial ponds, reservoirs, creek pools, irrigation ditches and other water bodies in plains grassland, sandhills, stream valleys, or canyon bottoms; elevations below 6,000 ft.
BIRDS				
American peregrine falcon <i>Falco peregrinus anatum</i>	S		HAB	wide variety of habitats, selects cliff ledges or rock outcroppings for nesting, preferring high, open cliff faces that dominate the surrounding area.

SPECIES COMMON AND SCIENTIFIC NAME	STATUS ¹	POTENTIAL TO OCCUR	RATIONALE FOR EXCLUSION ²	HABITAT DESCRIPTION AND RANGE IN COLORADO
American Pipit <i>Anthus rubescens</i> (WRNF MIS)	MIS	X		open-country birds in all seasons. They breed in alpine areas, near seeps, streams, lakes, or wet meadows. During migration and winter, they come down into the lowlands and can be found on beaches, marshes, agricultural fields, short-grass prairies, and mudflats.
Bald eagle <i>Haliaeetus leucocephalus</i>	S	X		near open water including rivers, streams & lakes, nesting & roosting in large ponderosa pine, Douglas-fir, or cottonwood trees in proximity to open water and rivers.
Black swift <i>Cypseloides niger</i>	S		HAB	nests on cliffs near or behind high waterfalls.
Boreal owl <i>Aegolius funereus</i>	S	X		high elevation, subalpine mature & old-growth coniferous woodlands, including mature Engelmann spruce, subalpine fir or spruce/fir-lodgepole pine forests, interspersed with meadows, nesting in cavities in trees larger than 15 inches dbh.
Brewer's sparrow <i>Spizella breweri</i> (WRNF MIS)	S, MIS	X		Sagebrush, mountain meadows, and mountain shrub habitat in CO.
Columbian sharp-tailed grouse <i>Tympanuchus phasianellus columbianus</i>	S		ODR, HAB	Sagebrush/mountain shrub communities with >40% cover, short sparse bunchgrasses on knolls 6200' to 8500' elevation, not known to occur in Eagle or Lake county
Ferruginous hawk <i>Buteo regalis</i>	S		HAB	Flat rolling prairies semi-desert shrub-steppe, low elevation, 3000' to 9500' elevation
Flammulated owl <i>Otus flammeolus</i>	S	X		old-growth or mature ponderosa pine, ponderosa pine, & Douglas-fir forests, often mixed with mature aspen, nesting in cavities, feeding on insects.
Greater sage-grouse <i>Centrocercus urophasianus</i>	S		HAB, ODR	Sagebrush obligate with grass/forb understory in rolling or mountainous terrain, with water nearby in spring 4500' – 9000' elevation
*Gunnison sage grouse <i>Centrocercus minimus</i>	C, S		HAB ODR	tall dense stands of sagebrush near wet meadows with tall grasses for hiding; occurring primarily in SW & W CO, but also including Saguache & S Chaffee County.
Lewis' woodpecker <i>Melanerpes lewis</i>	S		HAB	lowland & foothill riparian forests, agricultural areas, urban areas with tall deciduous trees, & foothills including Wet Mountains & grasslands
Loggerhead shrike <i>Lanius ludovicianus</i>	S		HAB	open riparian areas, montane meadows, agricultural areas, grasslands, shrublands, & piñon/juniper woodlands in western valleys in E CO

SPECIES COMMON AND SCIENTIFIC NAME	STATUS ¹	POTENTIAL TO OCCUR	RATIONALE FOR EXCLUSION ²	HABITAT DESCRIPTION AND RANGE IN COLORADO
Northern goshawk <i>Accipiter gentilis</i>	S	X		primarily forest habitat, especially in mountains, nesting in lower portions of mature Douglas-fir, ponderosa pine, lodgepole pine, or aspen canopies; prefers mature or old-growth forest structure.
Northern harrier <i>Circus cyaneus</i>	S		HAB	spring & fall migrant in western valleys mountain parks, and eastern plains in CO inhabiting grasslands, agricultural areas, marshes & tundra in fall; 3,500-13,000 ft.
Olive-sided flycatcher <i>Contopus cooperi</i>	S	X		mature spruce-fir & Douglas-fir forests, especially on steep slopes or near cliffs, near bogs & meadows during the summer, 10,000-11,000 ft.
Purple martin <i>Progne subis</i>	S		ODR	Late-seral aspen near meadows and water <9000; elevation, secondary cavity nests in aspen
Sage sparrow	S		HAB	Contiguous big sagebrush & sage/greasewood 103; height, 1+ layers grasses and forbs <8200' elevation
Virginia's Warbler <i>Vermivora virginiae</i> (WRNF MIS)	MIS		HAB, ELE	this species nests in summer in drought-tolerant pinyon/juniper and oak woodlands; It nests in or near coniferous forests usually between 6,000 and 9,000 feet. Needs dry landscapes with dense shrub cover for breeding
White-tailed ptarmigan <i>Lagopus leucurus</i>	S		HAB	Inhabit alpine tundra with moist, low-growing alpine vegetation, particularly willows (<i>Salix</i> spp.), with boulders, in proximity of water.
Yellow-billed cuckoo (eastern subspecies) <i>Coccyzus americanus</i>	S		ODR	Eastern subspecies: riparian forests along the Arkansas River & urban areas with tall trees; a rare to uncommon spring & fall migrant & summer resident of E CO & SW KS
MAMMALS				
Abert's squirrel <i>Sciurus aberti</i> (SINF MIS)	MIS		HAB	closely associated with, and nearly confined to cool, dry interior ponderosa pine forests. ¹
American marten <i>Martes americana</i>	S	X		spruce-fir & lodgepole pine mature to old-growth forests with moderate to high density canopy closures & abundant snags & logs; 8,000- 13,000 ft.
Cave Bats (WFNF MIS)	MIS		HAB	Bat species that roost or hibernate in caves.
Common hog-nosed skunk <i>Conepatus leuconotus</i>	S		HAB ODR	grasslands & foothills, prefers partly wooded, brushy, rocky area; SE & south-central CO.

SPECIES COMMON AND SCIENTIFIC NAME	STATUS ¹	POTENTIAL TO OCCUR	RATIONALE FOR EXCLUSION ²	HABITAT DESCRIPTION AND RANGE IN COLORADO
Elk <i>Cervus canadensis nelsoni</i> (SINF and WRNF MIS)	MIS	X		Coniferous forests associated with rugged, broken terrain or foothill ranges; summertime spent in high mountain meadows
Fringed myotis <i>Myotis thysanodes</i>	S		ELE	rocky outcroppings in mid-elevation ponderosa pine, piñon/juniper, oak, & mixed conifer woodlands, and pine forests grasslands, deserts, & shrublands; Baca, El Paso, Huerfano, Las Animas, Otero, & Pueblo counties. Up to 10,000 ft. elevation
*Gunnison's prairie dog <i>Cynomys gunnisoni</i>	C, S		HAB ODR	shrub-grassland habitats in SW CO in mesic plateaus and intermountain valleys, benches, and arid lowlands.
Hoary Bat <i>Lasiurus cinereus</i>	S	X		roosts on trees hidden among foliage, but on occasion in caves with other bats – it prefers coniferous forests and hunts over open areas or lakes
*North American Wolverine <i>Gulo gulo</i>	C, S	X		alpine & subalpine mature/intermediate timbered areas around natural openings, including cliffs, slides, basins, & meadows, dependant on ungulates, historically in CO, extending the length of the Rocky Mts.
Pygmy shrew <i>Sorex hoyi</i>	S	X		occupies a wide variety of habitats in the mountains of CO at elevations above 9,600 ft., such as subalpine forests, edges of meadows, bogs, willow thickets, aspen-fir forests, and parklands.
River otter <i>Lontra canadensis</i>	S	X		occurs in streams, lakes, reservoirs, wetlands and marine coasts; reintroduction efforts occurred in the upper reaches of both the Arkansas and Platte Rivers in the 1970s.
Spotted bat <i>Euderma maculatum</i>	S		ODR, ELE	Desert specialist, cliffs, structures, tree cavities, arid <6000' elevation
Rocky Mountain bighorn sheep <i>Ovis canadensis canadensis</i>	S	X		prefers semi-open, precipitous terrain characterized by a mixture of steep and gentle slopes, broken cliffs, rocky outcrops, and canyons
Townsend's big-eared bat <i>Plecotus townsendii</i>	S		ELE	typically associated with caves & abandoned mines for day roosts & hibernacula, will also use abandoned buildings in western shrubland, piñon/juniper woodlands, aspen, spruce/fir/, lodgepole & open montane forests in elevations up to 9,500 ft.

¹**Status Codes:** C= Federally candidate/proposed for listing; and S=Forest Service sensitive; MIS=Management Indicator Species

²**Exclusion Rationale Codes:** ODR=outside known distributional range of the species; HAB= no habitat present in Analysis Area; ELE= outside of elevational range of species; INV= presence of non-native salmonids.

APPENDIX D – MIGRATORY BIRD SPECIES OF CONCERN LISTED FOR THE BIRD CONSERVATION REGION – SOUTHERN ROCKIES

Bird Species	Potential to be in Project Area	Rationale for Exclusion	Habitat Description
Gunnison sage grouse <i>Centrocercus minimus</i>		ODR, HAB	tall dense stands of sagebrush near wet meadows with tall grasses for hiding; occurring primarily in SW & W CO, but also including Saguache & S Chaffee County.
American bittern <i>Botaurus lentiginosus</i>		ODR, HAB	large cattail marshes or wetlands with tall emergent vegetation; summer resident on eastern plains of Colorado and in mountain parks
Bald eagle <i>Haliaeetus leucocephalus</i>	X analyzed in sensitive species section		near open water including rivers, streams & lakes, nesting & roosting in large ponderosa pine, Douglas-fir, or cottonwood trees in proximity to open water and rivers.
Ferruginous hawk <i>Buteo regalis</i>		HAB	Flat rolling prairies semi-desert shrub-steppe, low elevation, 3000' to 9500' elevation
Golden eagle <i>Aquila chrysaetos</i>	X Potential impacts reduced by design criteria 11,12,14, and 15		favor partially or completely open country, especially around mountains, hills, and cliffs. They use a variety of habitats ranging from arctic to desert, including tundra, shrublands, grasslands, coniferous forests, farmland, and areas along rivers and streams.
Peregrine falcon <i>Falco peregrinus anatum</i>		HAB	wide variety of habitats, selects cliff ledges or rock outcroppings for nesting, preferring high, open cliff faces that dominate the surrounding area.
Prairie falcon <i>Falco mexicanus</i>		HAB	inhabit grasslands, shrub-steppe, deserts, cliff bands and other open areas of the West up to about 10,000 feet elevation
Snowy plover <i>Charadrius nivosus</i>		HAB, ODR	Barren to sparsely vegetated sand beaches, dry salt flats in lagoons, dredge spoils deposited on beach or dune habitat, levees and flats at salt-evaporation ponds, river bars, along alkaline or saline lakes, reservoirs, and ponds.
Mountain plover <i>Charadrius montanus</i>		ODR, HAB	Short grasslands occurring primarily on flat areas with short grass and scattered cactus; occurring mainly on eastern plains of CO
Long-billed curlew <i>Numenius americanus</i>		HAB	Primarily found in plains grasslands and sometimes in wheat fields or

Bird Species	Potential to be in Project Area	Rationale for Exclusion	Habitat Description
			fallow fields and nests close to standing water
Yellow-billed cuckoo <i>Coccyzus americanus</i>		ODR	Eastern subspecies: riparian forests along the Arkansas River & urban areas with tall trees; a rare to uncommon spring & fall migrant & summer resident of E CO & SW KS
Flammulated owl <i>Otus flammeolus</i>	X analyzed in sensitive species section		old-growth or mature ponderosa pine, ponderosa pine, & Douglas-fir forests, often mixed with mature aspen, nesting in cavities, feeding on insects.
Burrowing owl <i>Athene cunicularia</i>		HAB	Nests primarily in rodent burrows in grasslands, shrublands, deserts and grassy urban areas; most observations in eastern third of CO
Lewis's woodpecker <i>Melanerpes lewis</i>		ELE, HAB	lowland & foothill riparian forests, agricultural areas, urban areas with tall deciduous trees, & foothills including Wet Mountains & grasslands; elevation preference 3,500-7,000 ft.
Willow flycatcher <i>Empidonax traillii</i>	X Potential impacts reduced by design criteria 24		Breeds in moist, shrubby areas, often with standing or running water, especially riparian willow thickets
Gray vireo <i>Vireo vicinior</i>		HAB, ODR	Found in desert scrub, mixed juniper or pinyon pine and oak scrub associations, and chaparral, in hot, arid mountains and high plains scrubland
Pinyon jay <i>Gymnorhinus cyanocephalus</i>		ELE, HAB	low-elevation conifer woodlands (primarily pinyon-juniper); restricted to elevation (4,500-7,500 ft.)
Juniper titmouse <i>Baeolophus ridgwayi</i>		HAB	Warm, dry open woodland, especially juniper woodlands
Veery <i>Catharus fuscescens</i>	X Potential impacts reduced through design criteria 14, 15, and 24		Breeds in damp, deciduous forests and riparian habitats. Prefers disturbed forest with denser understory. Also in shrubby habitats with small trees
Bendire's thrasher <i>Toxostoma bendirei</i>		ODR, HAB	Desert, especially areas of tall vegetation, cholla cactus, creosote bush and yucca, and in juniper woodland
Grace's warbler <i>Setophaga graciae</i>	X Potential impacts reduced through design criteria 14 and 15		Tall, mature pine
Brewer's sparrow <i>Spizella breweri</i>	X analyzed in sensitive species section		Sagebrush, mountain meadows, and mountain shrub habitat in CO.
Grasshopper sparrow <i>Ammodramus savannarum</i>		ODR, HAB	almost exclusively prefer the prairie grasses or grasslands with

Bird Species	Potential to be in Project Area	Rationale for Exclusion	Habitat Description
			rabbitbrush or saltbrush, all breeding evidence far east of the Forest
Chestnut-collared longspur <i>Calcarius ornatus</i>		ODR, HAB	Tall shortgrass prairie and introduced grasses; fairly common on the E and NE plains of CO, but is rare west to the base of foothills and accidental in mountains
Black rosy-finch <i>Leucosticte atrata</i>		HAB	Breeds in alpine areas, usually near rock piles, and cliffs. Winters in open country, including mountain meadows, high deserts, valleys, and plains
Brown-capped rosy-finch <i>Leucosticte australis</i>		HAB	Above timberline wherever proper cliffs, caves, rock slides, or old buildings provide nest sites, and where adequate feeding grounds on tundra, rock slides, snowfields, and glaciers are within commuting distance
Cassin's finch <i>Haemorhous cassinii</i>	X Potential impacts reduced by design criteria 14 and 15		live in evergreen forests in the mountains up to about 10,000 feet elevation. In winter, they may move to lower elevations. They feed heavily upon seeds of pines and quaking aspen

*Habitat information and rationale for this table is tiered to Threatened, Endangered, and Forest Service Sensitive Species on the Pike and San Isabel National Forests (Wrigley 2012) as well as the online database provided by the Cornell Lab of Ornithology (Cornell Lab of Ornithology 2013).

Exclusion Rationale Codes: **ODR**= outside distributional range of the species; **HAB**=no habitat present in Analysis area; **ELE**=outside elevational range of species

APPENDIX E – MAP OF ALTERNATE 1 (PROPOSED ACTION)
SCALE: 1:24,000